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A TREATISE

ON THE

Diseases and Injuries

OF THE

LARYNX AND TRACHEA;

FOUNDED ON THE ESSAY

TO WHICH WAS ADJUDGED THE JACKSONIAN PRIZE FOR 1835.

By FREDERICK RYLAND,

SURGEON TO THE TOWN INFIRMARY, BIRMINGHAM.

PHILADELPHIA:

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PREFACE.

The Diseases of the Larynx and Trachea are of so serious a nature and of such frequent occurrence, they are attended by such great inconveniences during their continuance, and terminate fatally so often and with so much rapidity, that they require, perhaps more than any other class of diseases, an accurate knowledge of the symptoms by which they may be distinguished, clear views of their pathology, and promptitude and vigour in their treatment. Under these circumstances, it might reasonably have been expected that the medical literature of this country would have contained many volumes on a subject of so much importance. The reverse, however, is the case; and with the exception of Mr. Porter's excellent work *On the Surgical Pathology of the Larynx and Trachea*, there is, I believe, no single book which professes to treat on the whole of these diseases, or even on any large portion of them. At the same time, the periodical medical publications contain, with reference to this subject, a large number of valuable facts and observations, which are the records of the practice and opinions of thinking men, but which lose much of their value by isolation and diffusion. My object in writing the present work has been to collect the materials so profusely scattered about, to compare them with the results of my own experience, and to form, on the

basis of the two combined, a *Practical Treatise* on the Diseases and Injuries to which the Larynx and Trachea are liable. The want of such a work I have myself repeatedly experienced, and this attempt to supply the deficiency is offered to the public with the hope that it may, at all events, excite more attention to these maladies than they have hitherto received, and that it may afford useful information to those who, from a different direction of their studies, may not have had the opportunity of making themselves sufficiently acquainted with this very important class of diseases.

Birmingham, May 12, 1837

DISEASES

OF

THE LARYNX AND TRACHEA.

CHAPTER I.

ANATOMY OF THE LARYNX AND TRACHEA.

The larynx is situated in the upper and front part of the neck, its inferior margin having a membranous connection with the upper ring of the trachea, with the cavity of which organ it freely communicates. Its superior edge is placed immediately below the pharynx and the root of the tongue, and is attached to the os hyoides by the hyo-thyroid membrane in front and at the sides, and posteriorly by two round ligaments, nearly an inch in length, which unite the extremities of the cornua of the os hyoides to the great cornua of the thyroid cartilage. The thyro-hyoides muscle forms another link of connection between the os hyoides and the thyroid cartilage.

The anterior surface of the larynx is covered only by the skin and by the sterno-hyoidei and sterno-thyroidei muscles; the posterior surface is in immediate contact with the pharynx and the back of the mouth.

The larynx is composed of a strong frame-work of cartilages, which afford protection to the more delicate internal parts, and give points of support for the muscles necessary to the production of the vocal phenomena; muscles to move these cartilages in various directions; articulations with their accompanying ligaments; vessels, nerves, glands, and a mucous membrane, which lines the interior of the larynx throughout.

THE CARTILAGES.

Of the cartilages that enter into the structure of the vocal organs, the *thyroid* is the largest; placed at the front and sides of the larynx, it is formed of two broad alæ, which meet anteriorly at an

acute angle, having at its upper part a deep notch; the alæ posteriorly are broader and more widely separated above than below. A projecting line is distinguishable on each ala, proceeding from behind downwards and forwards. The posterior margins of this cartilage are thicker than the other parts, rather rounded, and each of them terminates above in a long process called the great cornu, and which, as I before remarked, is united by a ligament to the extremity of the os hyoides; below, there is a corresponding process, shorter and rather inclined inwards, which is articulated with the cricoid cartilage; this is called the lesser cornu of the thyroid.

The *cricoid* cartilage forms a very strong ring, of an irregular shape externally, but internally tolerably round; it is much higher behind than before, and presents four articulating surfaces, all of them convex in shape; two on the sides, which are in contact with the lesser cornua of the thyroid cartilage, and two on the upper and posterior part, to which are attached the arytænoid cartilages. On the median line behind there is a projecting ridge which separates two small fossæ, whence arise the crico-arytænoid muscles. There is a space in front between the lower margin of the thyroid and the upper margin of the cricoid cartilage, which is occupied by a strong and highly elastic membrane, called, from its situation, the crico-thyroid membrane.

The articulation of these cartilages with each other is effected by the reception of a small convex surface, situated at the lower and back part of the side of the cricoid cartilage, into a slight concavity on the inner side of the extremity of the lesser cornua of the thyroid cartilage. There is a synovial membrane, and an anterior and posterior ligament to strengthen the joint, and guard it from the effects of excessive motion. Considering the cricoid cartilage as the stationary body, the thyroid has upon it a slight movement of rotation, which is very important in the production and alteration of the voice.

The *arytænoid* cartilages are two bodies of an irregularly triangular shape, placed upon the upper posterior edge of the cricoid. They each present three surfaces—an internal one, which is placed opposite to that of the corresponding cartilage; an anterior one, into the base of which are implanted the thyro-arytænoid ligament and the tendons of the crico-arytænoideus and thyro-arytænoideus muscles; and the posterior face, to which are attached the transverse and oblique arytænoidei muscles.

The nature of the joint between the arytænoid and the cricoid cartilages is arthrodial; a small, convex, articular surface on the latter being received into a shallow concavity in the base of the former. Motion to a slight degree is allowed in almost every direction, but considerable latitude inwards and outwards is permitted. The ligaments that guard this articulation are, 1st, a broad posterior ligament, of a triangular shape; it allows very little forward motion to the arytænoid cartilages; 2d, an internal ligament, more loosely

attached, permitting considerable deviation externally: and, 3d, a remarkable ligament in front, called the *corda vocalis*, which has most important duties to perform, independent of its restrictive action on the crico-arytænoid articulation. It is about two lines in breadth, and varies in length from half to three quarters of an inch. Posteriorly, it is attached to the lower part of the anterior face of the arytænoid cartilage, whence it proceeds horizontally forwards to be fixed to the thyroid, near the middle of the reentrant angle; its fibres intermix with those of the corresponding ligament of the other side. It is highly elastic. The *corda vocalis* has been described as the tendon of the thyro-arytænoid muscle, and again as a mere fold of the aponeuroses of this muscle and the crico-arytænoideus lateralis; certainly, some of the fibres of the former of these are attached to it, but they do not terminate in it as the fibres of a muscle usually do in their tendon, nor has it the properties of a tendon, these parts possessing but little elasticity, whilst the vocal ligament is remarkable for this quality. This ligament is covered on each side by mucous membrane, and the pair, together with their mucous covering, form the lateral boundaries of the rima glottidis.

Upon the summit of each arytænoid is found another small moveable cartilage, of an irregular shape, called the cartilage of Santorini, or corniculum laryngis.

The *epiglottis* belongs to that class of bodies called fibro-cartilages; it is of an ovoid shape; the upper lateral edges are slightly inclined forwards, whilst the lower edges are turned backwards towards the cavity of the larynx. It is placed immediately below the base of the tongue, and above the entrance to the larynx, which it guards from the ingression of food during the act of deglutition. The epiglottis is attached below by ligamentous fibres to the notch in the anterior face of the thyroid cartilage; the upper and lateral edges are free. The whole of the posterior, and great part of the anterior face, are covered with mucous membrane.

THE MUSCLES.

The *crico-thyroidei* are two small muscles, external to the larynx and placed on the lower and lateral parts of this organ; they arise on each side from the anterior half of the cricoid cartilage, whence they proceed backwards and upwards, to be inserted into the inferior margin of the thyroid cartilage. The obvious use is to draw the lower front edge of the latter cartilage towards the former, and thus diminish the space occupied by the crico-thyroid membrane. The only antagonists of this pair of muscles within the larynx are the *thyro-arytænoidei*, which arise from the inferior half of the reentrant angle of the thyroid cartilage, just below and a little external to, the insertion of the *cordæ vocales*; their fibres run parallel to the vocal cords, have a strong connection with them, and terminate posteriorly by an attachment to the base of the front edge of

the arytaenoid cartilages; by drawing forwards these cartilages, they shorten the vocal ligaments, and in some degree widen the rima glottidis; and, inasmuch as the arytaenoides are firmly fixed to the cricoid by a strong ligament posteriorly, these muscles will act as antagonists to the crico-thyroidei, and will raise the thyroid cartilage, and thus increase the crico-thyroid space, and put the membrane in that situation on the stretch.

The *crico-arytaenoidei postici*.—These muscles arise from the depression found on each side of the salient line at the back of the cricoid cartilage; they are inserted into the base of the posterior surface of the arytaenoid cartilages. They widen the rima glottidis by separating the arytaenoid cartilages.

The *crico-arytaenoidei lateralis* have their origin from the superior circumference of the cricoid cartilage; their fibres, proceeding upwards and backwards, are fixed to the base of the arytaenoid. Their use is also to widen the aperture of the glottis.

The muscles principally instrumental in closing the vocal aperture are the *arytaenoidei transversi* and *obliqui*, the former of which are the more external. The fibres of these muscles pass from one arytaenoid cartilage to the other. A few muscular bands can sometimes be traced going from the arytaenoid to the sides of the epiglottis, but they are unimportant and not always present.

The larynx is supplied with blood by branches from the thyroid arteries; one vessel constantly found is the crico-thyroid artery, which ramifies on the membrane of that name. Its nerves are derived from the eighth pair, and from the cervical ganglia of the sympathetic.

The inferior laryngeal, or recurrent nerves, supply only the crico-arytaenoidei postici and laterales and the thyro-arytaenoidei muscles, which are the dilators of the glottis, and also the mucous membrane covering the posterior part of the larynx.¹ The superior nerves are principally distributed to the lining membrane of the larynx, but they give branches to the arytaenoidei and crico-thyroidei muscles.

The glands of the larynx are the *epiglottic*, situated at the root of the epiglottis, between it and the hyo-thyroid membrane; and the *arytaenoid*, which is formed of a number of small glandular grains, placed within the folds of the mucous membrane that go from the arytaenoid cartilages to the sides of the epiglottis.

¹Meckel and Quain speak also of branches to the arytaenoidei muscles: I have dissected many larynges in order to ascertain this point, and in no instance have I been able to trace any branches of the recurrent nerve to the closing muscles of the glottis. After supplying the trachea and the inferior constrictor of the pharynx, this nerve sends a long and important twig to the mucous membrane, covering the posterior part of the lips of the glottis; on reaching the crico-thyroid articulation, it gives a branch to the crico-arytaenoideus posticus; then, passing between the thyroid cartilage and the crico-arytaenoideus lateralis, it distributes filaments to that muscle, and terminates in the thyro-arytaenoideus.

THE MUCOUS MEMBRANE.

The mucous membrane completely lines the cavity of the larynx; it is continuous above with that of the pharynx, and below with the membrane lining the trachea.

Upon the anterior surface of the epiglottis the mucous membrane forms three folds; the centre one, running down the median line, is the most distinct; their use is simply to allow that facility of motion to the epiglottis which the exercise of its functions requires. To the laryngeal surface of this organ the mucous membrane is strictly united; from its lateral edges the membrane proceeds to the summits of the arytaenoid cartilages, during which course its cellular surfaces are in contact with each other. At the base of the *external* edge of the arytaenoid it forms another fold which goes horizontally forwards, towards the angle of the thyroid cartilage; this is denominated the *superior ligament* of the glottis; lower down, from the base of the *anterior* edge of the arytaenoid, the membrane proceeds nearly in the same direction, enclosing within its duplicature the thyro-arytaenoid ligament, thus forming the *inferior ligament* of the glottis, or *corda vocalis*. Between these folds on either side a cavity is formed, of an oval shape, larger above than below, called the *ventricle* of the larynx, or *sacculus laryngis*; the membrane lining the lower part of this cavity rests upon the thyro-arytaenoideus muscle. After forming the inferior ligament of the glottis, the mucous membrane covers the internal surface of the cricoid cartilage, and the crico-thyroid membrane, and is then continued to the trachea.

The term *glottis* is applied to that part of the larynx, which is situated above the vocal cords. The lips of the glottis, which bound its upper aperture, are composed of the arytaenoid cartilages and the mucous membrane which first invests them, and then proceeds to the lower lateral edges of the epiglottis. The inferior ligaments of the glottis or vocal cords are formed of the thyro-arytaenoid ligaments and their investing membrane, and between them is the rima or chink of the glottis; the ventricles of the larynx are placed within the cavity of the glottis.

In its organisation the mucous membrane of the larynx exhibits nothing worthy of particular remark. According to the opinion of Béclard and Meckel it has no epithelium, whilst, on the contrary, Haller and Bichat assert that this, in common with all other mucous membranes, is covered by an epithelium. The mucous membrane is rather soft and pulpy, thicker than that which lines the sinuses and the excretory ducts, but less so than that of the intestinal canal. It has a pale rose colour, and is defended from the action of the air by a layer of transparent glairy mucus, secreted by the muciparous follicles, which exist abundantly within its substance; these are most developed on the inferior surface of the epiglottis, within the ventricles of the larynx, and over the arytaenoid cartilages.

The sub-mucous cellular tissue is very loose in those parts of the larynx that enjoy considerable capabilities of motion, as about the lips of the glottis, and around the sacculi laryngis. Mucous membranes generally possess a limited degree of extensibility, whilst, at the same time, they are in most instances connected with organs, the dimensions of which are undergoing continual change, the stomach and bowels for example. If the stomach or œsophagus be examined when in a state of contraction, the lining membrane will be found laid up in wrinkles or folds, and these are effaced when the organ is distended. A wrinkled condition of the mucous membrane of the larynx would, in all probability, interfere with the formation of the voice, or with the smoothness of its tones, and the necessity for this is obviated by the laxity of the attachment of this membrane to the subjacent parts around the rima glottidis, and it appears probable that one especial use of the sacculi laryngis is to serve as a reservoir of mucous membrane during the contraction and expansion of the vocal aperture.

The mucous membrane of the larynx does not enjoy a high degree of sensibility; the upper part, that especially round the lips of the glottis, seems to possess more of this quality than the interior of the organ, or than the membrane lining the trachea. At the same time the utility of this arrangement is so obvious, that I need not enter into any discussion of the reasons for it. We observe throughout the whole system of mucous membranes in the body that, towards the commencement or termination of any particular canal that is lined by a membrane of this kind, the degree of common sensation becomes increased; and, with respect to the larynx, the glottis may be considered as the orifice of a new tract of membrane, and has, therefore, according to the general law, additional powers of sensation.

In inflammation of the air passages the pain is comparatively trifling; it differs from the acute sensations caused by the inflamed condition of a serous membrane, the pleura for instance; it is more a feeling of heat.

The mucous secretion is very moderate in quantity, bland, and transparent; it is insoluble in water, and coagulates neither by heat nor cold.

ANATOMY OF THE TRACHEA.

The *trachea* commences immediately below the larynx, at about the level of the fifth cervical vertebra; it is nearly five inches in length, situated exactly in the median line of the neck, and divides, at its inferior extremity, into the two bronchi. It is separated from the integuments by a strong fascia in front and at its upper part, and is partially covered by the sterno-hyoidei and sterno-thyroidei muscles, and by the thyroid gland. The carotid artery, jugular vein, and nervus vagus, are situated on either side of it.

The trachea is composed of a highly elastic fibrous tissue, the direction of the fibres being longitudinal. Within this, which forms

the external layer of the tube, are placed the cartilaginous rings, to the number of from sixteen to twenty. They are incomplete, open at their posterior part, and surround only the anterior and lateral parts of the tube. The first ring of the trachea is very broad in front and narrow behind, being, in these respects, exactly the reverse of the cricoid cartilage.

The posterior part of the trachea is composed of thin bands of muscular fibres; these fibres have a transverse direction, and are attached to the extremities of the cartilaginous rings and to the fibrous tissue which occupies the intervals between those rings.

The wind-pipe is lined throughout by a thin mucous membrane which is continuous above with that of the larynx, and below with that which lines the bronchi.

CHAPTER II.

DEVELOPMENT OF THE LARYNX AND TRACHEA, AND THEIR CON- GENITAL MALFORMATIONS.

The larynx is completely formed at the time of birth; it increases in size very slowly during the first few years of life, so that scarcely any difference can be perceived between the larynx of a child of three years and that of another of ten or twelve years of age¹. Previous to the time of puberty, both sexes have the larynx equally developed, and formed exactly on the same type; but at that period a remarkable change takes place in the larynx of the male. The thyroid cartilage acquires a great increase of size in all its parts, the anterior angle becomes more acute, and projects considerably, forming that prominence in front of the neck called the *pomum Adami*; the vocal cords, being attached to the reentrant angle of the thyroid, are, of course, greatly lengthened by this projection of its anterior portion, and thus the rima glottidis becomes enlarged. The larynx of the adult male is more than a third larger than that of the female, and the strength of the cartilages corresponds to the increase of size. The aperture of the glottis, after the time of puberty, is nearly double the dimensions, both as to length and breadth, that it was before that epoch. In the female, the form of the thyroid cartilage and the dimensions of the glottis undergo very little change at the age of puberty; and the same thing is noticed in males who have been early castrated, or in whom the genital organs are not developed. The glottis scarcely enlarges so much as in the proportion of from five to seven in females, on attaining the age of puberty.

The development of the trachea is not marked by any striking

¹ Richerand, Mem. de la Soc. Med. d'Emulation, tom. iii., p. 326.

period of increase, like that of the larynx; its dimensions enlarge gradually, like the other organs of the body. Its length is about the same in adults of both sexes, and corresponds with the length of the neck; its width, which is equal throughout its whole extent, has reference to the size of the lungs. The diameter of the trachea is greater in males than in females, being about ten lines in the former and eight lines in the latter.

CONGENITAL MALFORMATIONS.

Original defects and vices of conformation are less common in the larynx and trachea than in almost any other organ of the body. M. Geoffroy Saint Hiliare, in his elaborate work upon *Les Anomalies d'Organisation*,¹ remarks that he has never known any example either of absence or of a double formation of the larynx, of the trachea, or of the bronchi. The epiglottis has occasionally been deficient, and it has been found adherent to the base of the tongue.² M. Billard has once observed, upon a new-born infant, a very marked defect in symmetry between the two lateral parts of the larynx.³ He has also seen, in another case,⁴ a great degree of narrowness in the larynx, whilst this organ had its natural length. In this child, the orifice of the mouth was only six lines in diameter; and the diameter of the base of the tongue was also only six lines; the distance between the great cornua of the os hyoides was seven lines. All these parts had their natural length but not the breadth which is proper to them; so that it appeared as though the lateral parts of the face had been compressed, with the effect of putting a stop to their development in width.

Dr. Houston⁵ relates a case which occurred within his own observation, where the œsophagus communicated by a large aperture with the posterior part of the trachea; the pharynx was unusually wide, and terminated some way down the neck in a cul de sac, without having any connection with the œsophagus. The larynx and its muscles were all perfect. This infant lived about twenty-four hours. On every attempt to suck, fits of coughing immediately supervened, threatening suffocation by their violence, and lasting till the milk was all disgorged again. The only way in which food could get into the stomach was by first passing through the rima glottidis, and then reaching the œsophagus from the opening in the posterior part of the trachea.

The above are the principal malformations of the larynx and trachea that are found described by authors, and the infrequency with which they occur gives strong confirmation to the general rule laid down by M. Geoffroy Saint Hiliare, that in proportion to the importance of the functions of any organ is the rarity with which it is found to deviate from its normal condition.

¹ P. 729.

² Ibid. p. 550.

³ *Traité des Maladies des Enfants*, p. 494.

⁴ Ibid. p. 207.

⁵ *Dublin Hospital Reports*, vol. v., p. 310.

CHAPTER III.

PHYSIOLOGY OF THE LARYNX.

The larynx combines within itself the execution of two very important functions of the animal economy; one of which is intimately connected with our physical condition, the other with our moral and intellectual state.

The former of these—the most momentous by far—consists in the admission of air into the lungs, the regulation in some degree of its quantity, and in the resistance afforded to the ingression of foreign bodies which, by their presence within the lungs or larger air tubes, would be injurious or even destructive to life.

The latter function is the production of the voice, and it is this which chiefly demands that complicated structure, that combination of cartilages, articulations, and muscles, into the description of which I have previously entered.

During the performance of ordinary silent respiration, the larynx is quite in a passive state, the rima glottidis is widely opened by the retraction of the arytaenoid cartilages from one another, and the air passes into the lungs and back again without encountering any opposition. If any gas possessing irritating qualities, if much smoke or dust, be mingled with the air, the vigilance of the larynx is speedily aroused, and a frequent short cough is the answer that the lungs return to the call made upon them by the irritated larynx to expel from their interior the offending particles. That this cough is more the effect of the irritation of the larynx than of the bronchial membrane, appears from these circumstances; 1st, that, on such occasions, an uneasiness and sense of heat are felt at the situation of the rima glottidis; and, 2dly, that the same effect can be produced by mechanically tickling the laryngeal cavity. Sneezing may be cited as another instance of the same kind of sympathy as that just mentioned; the irritation that causes the latter action being situated within the nasal cavity, the air is forcibly expelled from the lungs through the nostrils.

If any thing in a more tangible shape present itself at the rima—as a crumb, for example—the muscles that close this aperture are instantly thrown into violent action, and so long as the foreign body remains in contact with the lips of the glottis they refuse to open, except to allow the air to be driven forcibly from the lungs, in the hope that the intruder may be dislodged. On these accounts it is highly necessary that, during the act of deglutition, some effectual bar should be placed to the contact of the food with the entrance of the larynx, and this is found in the epiglottis.

The epiglottis is situated immediately below the os hyoides and base of the tongue; its inferior extremity is attached to the upper and front part of the thyroid cartilage, whilst its superior portion is

loose and projects into the pharyngo-buccal cavity. It thus acts the part of a valve; and when, in the act of deglutition, the larynx is drawn upwards, and the posterior part of the tongue is pushed downwards, the epiglottis, independent of the aid of any muscles that may be attached to it, completely covers the laryngeal aperture, and directs the food towards the œsophagus. Cases are recorded in which this cartilage has been removed both by accident and by disease; and here the muscles that shut the rima have, after a little time, become amply sufficient to defend the larynx from the ingress of the food during the process of swallowing, but nature has added the epiglottis, apparently with the view of affording a more complete protection in a matter so essential to the preservation of life.

With regard to the second function of the larynx—the formation of the voice—there are few subjects on which physiologists have differed so much, if we may judge, at least by the numerous theories that have been offered, at various times, as explanatory of the production of the vocal phenomena. This may be accounted for in some measure, by the unsettled state of the science of acoustics, and by the difficulty of bringing observation to bear upon the workings of an organ like the larynx, so completely hidden from sight.

It is by no means my intention to enter into the merits of the different hypotheses that have been put forth, from time to time, on this subject: I shall content myself with giving that view of the action of the larynx, which appears to be supported by considerations of its structure and capabilities, and to be corroborated by the effects upon the voice of pathological changes in the organ.

That the primary vocal sound is produced by air passing through the larynx may be considered proved by the fact that, when an opening is made into the trachea, the power of speech is lost, and is recalled again on closing the artificial aperture. That the thyro-arytænoid ligaments act a part in the formation of the voice, is also proved by the complete aphonia that results from their destruction. That the action of some of the laryngeal muscles is necessary, is shown by the effects of the division of the nerves which actuate them. We have to consider what part each of these agents performs, and in what manner their combined action is instrumental in eliciting the vocal sound.

Little need be said with respect to the air; it is driven through the larynx, by means of the muscular apparatus of the chest, with greater velocity during the production of voice than in ordinary silent respiration. In beginning to speak we are sensible of a muscular effort in the larynx, and in the chest, the effects of which are, in the larynx, to retard or control the transit of the air; and in the chest, to expel the air more rapidly than before; and from the combination of both these actions, to give it some degree of condensation.

The thyro-arytænoid ligaments and their investing mucous membrane form the lateral boundaries of the rima glottidis, which

is by far the narrowest part of the larynx, and the part, therefore, where the pressure of the condensed air from the lungs is exerted with the greatest force. During silent respiration, the chink of the glottis is expanded and has then a triangular form, the vocal cords being approximated to each other at their thyroideal, and considerably separated at their arytænoidal extremities; but when the vocal powers are called into request, they are thrown nearly into a state of parallelism and the rima is rendered considerably narrower.

Assuming it as proved that the rapid passage of the air through the glottis is one condition necessary for the production of voice, we have to determine, in the next place, what are the modifications that the air undergoes in its passage through the rima, and what other action the ligaments, which form the lateral boundaries of this aperture, have than that of obstructing and condensing the air in its exit from the lungs.

The opinion promulgated by Ferrein, in the middle of the last century, that the vocal sound was caused by the ligaments of the glottis, or vocal cords as he denominated them, vibrating like the strings of a musical instrument, is now generally abandoned, and for the following reasons;—1st. That the sound of the human voice has no resemblance to that of a stringed instrument. 2d. That the altitude or gravity of the tone can be effected by the widening or contraction of the rima glottidis, without giving different degrees of tensity to the vocal ligaments. 3d. That these ligaments are absolutely longer during the highest notes than in those lower in the scale; a condition utterly at variance with that of musical cords when eliciting notes of a similar character. And, lastly, there are no cords to vibrate, the vocal ligaments being enclosed in a duplicature of mucous membrane, which is continuous with that lining the other parts of the larynx, and having themselves extensive connections, on the external side, with the thyro-arytænoid muscle; so that absence from moisture, and isolation in the middle part of their course—both which are conditions necessary for the perfect action of musical cords—are, nevertheless, wanting in the construction and arrangements of the thyro-arytænoid ligaments.

The idea formerly entertained, that the larynx, in its action resembled a common wind-instrument—a flute, for example—is still less tenable; for the vocal organ has nothing in its structure that will bear any comparison either to a common flute, or to a pipe with its mouth-piece or beak.

Numerous attempts have been made, at different times, to produce a machine which should imitate the larynx, and elicit sounds similar to those of the human vocal organ; but their complete failure, in the majority of instances, and the extremely partial success that has attended even the best amongst them, have served to confirm the belief that the larynx is an instrument *sui generis*, and that the phenomena to which it gives rise can be elucidated only by observation and experiment. It may, however, be remarked, that the most successful imitations of the human voice have been given

by instruments containing a reed surmounted by a tube capable of varying in length, or by a wooden box of a conical shape, the mouth or external opening of which could be enlarged or diminished at pleasure, and the whole actuated by a current of air. Such instruments will produce a very good imitation of some of the vowel sounds.¹ In reeds, the sound is caused by the vibrations of one or two elastic plates, which are fixed on one of their sides and free on the three others, and which are set in motion by a forcible stream of air. But the vocal cords or ribands differ, in this important respect, from the tongue of a reed, that, instead of three, they have but one free edge. Notwithstanding this marked dissimilarity in the structure of the vibrating parts of the reed and of the larynx, the points in which the two organs resemble each other are highly important. In both the vibrations are caused by the contact of a rapid current of air; the number of the vibrations in a given time regulates, in a great measure, the acute or grave character of the sound; the primary note admits of easy modification by alterations in the length, or the size of the aperture, of any superadded tubes in the instance of the reed, and in that of the larynx by similar changes in those parts of the vocal tube situated above the glottis, as the pharynx, fauces, mouth, &c.

From these various considerations it appears that the vocal apparatus in man has many conditions in common with reed-instruments, and we may, therefore, make use of the latter in illustrating and explaining the former; though the vitality of the larynx, and the dependence that its powers of producing voice have upon the existence of this vitality, must always form a strong line of demarcation between the two. If we take a human trachea and larynx, and blow very strongly into the trachea towards the larynx, taking care at the same time to bring the arytaenoid cartilages into close contact, a sound will be produced something like the human voice; and in this experiment it is easily seen that the sound is caused by the vibrations of the inferior ligaments of the glottis.² But the voice thus produced admits of scarcely any variations in tone or in intensity. If the larynx were an instrument, depending on its mechanical construction merely for the power of eliciting the tones of the voice, by regulating the force of the air, the capacity of the rima, and the tensility of the ligaments of the glottis, we should be able, in the dead larynx and trachea, to produce vocal effects analogous to those in the living organs; but as this is not the case, we must seek for some other power superadded to the mechanism of the larynx, and indebted for its properties to the possession of vitality. Dutrochet, Magendie, Piörry,³ and most of the physiologists of the present day, consider this power as residing in the *thyro-arytaenoid* muscles. The reasons for this belief are,

¹ See Willis on Vowel Sounds, in the Cambridge Philosophical Transactions, vol. iii., part i.

² Magendie's Physiology, Milligan's trans., 2d edit., p. 134.

³ Dic. des Sciences Medic., art. Voix.

1st, the situation of these muscles, their attachment to the vocal cords, and the influence they are capable of exercising over the vibrations of these cords; 2d, the effects of the division of the recurrent nerves which supply these muscles—if both are cut the voice will cease, if only one is cut the voice will only be half lost;¹ 3d, the loss of voice that results from ulceration, purulent infiltration, or atrophy of these muscles. “The extinction of the voice is carried to the highest degree, if the thyro-arytænoid muscles have undergone any of the alterations that we have mentioned,” observes M. Andral.²

These observations are sufficient to prove that the contractions of the muscles in question are necessary to the production of voice, and, together with the experiments of Magendie—in which the glottis of an animal being laid bare at the moment that it cried, the vocal cords were seen vibrating—show beyond all doubt that the primary tone of the voice is due to the action of the thyro-arytænoid muscles and ligaments, and probably to their vibrating backwards and forwards, and thus alternately allowing and intercepting the passage of the air which is forcibly expelled from the lungs through the rima glottidis. The ventricles of the larynx, situated immediately above and external to the vocal ligaments, have the effect of insulating their upper surface and of affording them facilities for free vibration.

We have next to enquire what the circumstances are that influence the production of the different notes of which the voice is susceptible; the varying degrees of intensity of the voice; and the peculiar tone or quality which distinguishes the voices of different persons, ages, and sexes.

I. *Of the extent of the Voice, or the alteration of Note.*—The formation of the different notes of the voice must depend upon the varying tension of the vocal ligaments, the size of the aperture of the glottis, and the lengthening or shortening of the superior parts of the vocal tube. Magendie³ laid bare the glottis of a noisy dog, by cutting between the thyroid cartilage and the os hyoides; and he observed that, when the sounds were grave, the ligaments of the glottis vibrated in their whole length, and the expired air passed out in the whole extent of the glottis; whilst, during the production of acute sounds, the posterior parts of the vocal ligaments only vibrated, and the air passed only in the part that vibrated. By this experiment, two very important positions may be considered as established, viz., the diminution of the aperture of the glottis during the formation of an acute sound, and the shortening of the vibrating parts of the vocal ligaments, and, consequently, an increased celerity in their vibrations: the agents in effecting this condition of the glottis are unquestionably the *transverse and oblique arytenoid muscles*. When these muscles contract to their utmost extent, the rima is entirely closed, no air can pass, and, of course,

¹ Magendie, lib. cit., p. 144.

² Clinique Médicale, tom. ii., p. 208.

³ Lib. cit., p. 157.

no sound is produced: when they contract in a minor degree, the triangular aperture of the glottis may remain open throughout its whole length, as happens during the formation of grave notes, or it may diminish in length in proportion to the degree of contraction of the arytænoid muscles; in which case the anterior angle of the aperture of the glottis will be found at different distances from the thyroid cartilage, and the acuteness of the tone of the voice will have relation to the distance from the thyroid cartilage at which the angle of the aperture of the glottis, formed by the contact of its ligaments, is found. That the tension of the vocal ligaments is increased during the production of an acute note is easily proved by placing the finger outside the larynx, over the crico-thyroid space; the interval between the cricoid and thyroid cartilages will be found to diminish in proportion to the altitude of the note in the musical scale. The simultaneous elongation and increased tension of the vocal ligaments will necessarily take place when the cartilages are approximated; for the attachments of the ligaments are to the re-entrant angle of the thyroid in front, and to the arytænoid and posterior part of the cricoid cartilage behind, and the distance between these points is, at that time, greatly increased. The agents in effecting the extension of the vocal ligaments are the *crico-thyroid muscles*. It may be remarked, in corroboration of these views of the production of acute sounds, that both the sets of muscles to the agency of which their formation is chiefly ascribed receive their nerves from the superior laryngeal branch; and that after the division of this nerve in the living animal, the voice loses almost all its acute tones, and assumes an habitual gravity that it did not before possess.¹ The lower notes, it is scarcely necessary to remark, are produced during a widened state of the aperture of the glottis, and a relaxed condition of the vocal ligaments, and the agents in effecting the former are the *posterior and lateral crico-arytænoid muscles*, and the latter is brought about by the action of the *thyro-arytænoid muscles*. The last named muscles, from their situation close to the thyro-arytænoid ligaments, and within the vocal ribbons, must, by their relaxation or contraction, exert a powerful influence upon the tones of the voice, for we cannot conceive the vibrations of the edges of the glottis to be confined to the ligaments merely. When these muscles contract, they not only relax the vocal ligaments, but they give an additional degree of thickness and softness to the parts immediately external to the ligaments, and, probably, in this way diminish the number of the vibrations of the edges of the glottis in a given time.

With respect to the manner in which the note of the voice is influenced by the length of the superior parts of the vocal tube, very little is known; observation shows that, in giving rise to acute sounds, the whole larynx is raised, and that the contrary takes place during the production of grave sounds.

The *intensity or volume* of the voice depends upon the size of

¹ Magendie, lib. cit., p. 138.

the larynx, the capacity of the chest, and the power of the muscles that move the chest. The manner in which these circumstances may influence the intensity of the voice is too obvious to need much explanation. A capacious larynx is provided with vocal ligaments of a length proportionate to its size, and the extent of the vibrations they are able to perform must unquestionably have a marked effect upon the power of the voice. The great development of the larynx in men, contrasted with its smaller proportions in women and children, accords with the intensity and depth of tone by which the voices of the former are distinguished.

A large and muscular chest has, perhaps, a still more powerful influence over the volume of the voice; for the vigour with which the vocal ligaments vibrate must depend, in a great measure, upon the extent of the force that actuates them, and a chest possessed of the qualities just enumerated will, of course, expel the air through the larynx with greater power, and in larger quantities, than one of narrower dimensions and of inferior muscularity. During the prostration of strength that accompanies sickness, the voice, though it may be habitually powerful, loses much of its intensity, from an inability in the muscles of the chest to expel the air with their usual energy.

The *timbre or tone of the voice* depends in some degree upon the size of the larynx, but more particularly, perhaps, upon the structure of its cartilages and of the thyro-arytænoid ligaments. The softness of these parts in childhood, their strength and firmness in manhood, and the ossified condition of the cartilages in old age, are supposed to have considerable influence in modifying the tones of the voice at these different periods of life. Other circumstances that have a powerful effect in giving a certain quality to the voice are, the construction of the superior parts of the vocal tube, the extent of the mouth and of the aperture of the lips, and the development of the nasal fossæ.

The term, *vocal tube*, is given to the passages by which the air escapes after traversing the trachea and larynx; it has two external apertures, the mouth and the nostrils, which latter may be considered as one opening. It is composed of the pharynx, the buccal cavity, and the nasal fossæ, and contains parts that are capable of entering into distinct vibration, as the soft palate, the tongue, the cheeks, and lips. It modifies the primary tone of the voice in the same way that the tube of a reed instrument affects the tone formed by the reed itself.

It is not my province to enter into the details to which the full consideration of the influence of the vocal tube upon the note, quality, or intensity of the voice would lead me. The changes that the vocal tube undergoes during the transmission of sounds of different character cause it to resemble, in a striking manner, the various kinds of tubes which are affixed to reeds when similar modifications of their tones are desired. Thus, in the human vocal apparatus, when a high note is sounded, the larynx is drawn

upwards towards the palate, and the vocal tube is, consequently, shortened: reed organ-pipes are, in like manner, shorter in proportion to the altitude of the note in the musical scale. Intensity is given both to the voice and to the tone of an organ-pipe by an expanded condition of the apertures through which both sounds ultimately escape. An organ-pipe, closed at its upper end, gives a note nearly an octave lower than a pipe of the same dimensions in which the upper aperture is perfectly open; in like manner, the note and tone of the human voice are affected by the partial closure of the lips; the former is rendered graver, and the latter softer and mellower.

In a natural state of the vocal apparatus, the nasal cavities have little to do with the formation of the voice, and singing, independent of articulation, is perfectly unaffected either by an open or closed condition of the nasal apertures; if, however, the velum palati, whose office it is to close the communication between the mouth and nose, is destroyed by disease, the sound then traverses the cavities of the nose, and the voice acquires a nasal twang.

The velum palati has probably other uses in the modification of the voice than that just specified. The falsetto voice has evidently a strong dependence upon the action of this organ; for we find that persons in whom this kind of voice exists in much perfection have the velum palati, the uvula, and the adjacent parts, very largely developed; and after singing long in the falsetto voice great fatigue is experienced in these organs. Probably, during the evolution of the falsetto notes, the vocal tube should be considered as terminating at the isthmus of the fauces.

CHAPTER IV.

PATHOLOGY OF THE MUCOUS MEMBRANE.

In order to facilitate the description of the effects of disease upon the mucous membrane of the larynx and trachea, I shall here give a general view of the pathological changes that occur in this membrane as the consequence of inflammation; reserving for future opportunities the more particular details of the results of morbid action upon this surface.

The effects of inflammation upon the mucous membrane of the air-passages, are, 1st, a change in its colour. During a state of health, the surface of the membrane has a pale rose colour, which, on the occurrence of acute inflammation, increases in intensity, and ultimately becomes purple or deep violet. In the sub-acute and chronic forms of inflammation the colour is not so deep, and, instead of being uniformly diffused, it is often distributed in patches, with spaces between of the normal appearance. These coloured patches,

however, are never bounded by exactly determined lines, but the red or violet colour of their centre becomes diluted towards the circumference, till it gradually subsides into the natural pale rose colour of the uninflamed membrane.¹ The intensity of the colour varies according to the situation of the inflamed parts; as, for instance, when the membrane covering the vocal cords or the rings of the trachea—to which part it has a firm cellular adhesion—takes on inflammatory action, the increase of colour is comparatively trifling, whilst the more loosely attached parts of the membrane in the immediate vicinity become deeply red or violet from the same exciting cause, whatever its nature may be.

A second effect produced by inflammation in these membranes is an increase in their thickness; they become swelled and pulpy. This is, in some measure, caused by the additional quantity of blood that the membrane receives, but still more by an interstitial infiltration of serum within its substance. The sub-mucous cellular tissue most commonly participates in the morbid actions that affect the contiguous membrane and readily becomes the subject of interstitial serous deposition upon any increased action of its vessels, and in proportion to the quantity and the laxity of texture of this tissue is the extent to which the apparent increase of thickness of the membrane may be carried. Thus, the lips of the glottis, under the influence of acute inflammation, are often so much swelled as almost to prevent the passage of the air in respiration; whilst the same measure of inflammatory action in that part of the mucous membrane which covers the cricoid cartilage, or the rings of the trachea, will scarcely increase its thickness in a sensible degree. In the former situation, the greater extensibility of the mucous membrane and the laxity of its sub-mucous tissue allow of serous infiltration to an extent that the strictness of the connection between the membrane and the subjacent cartilages in the latter situation effectually prevents.

The interstitial deposition of lymph, or true hypertrophy of the mucous membrane, is always the result of a more chronic species of inflammation than that which causes the serous infiltration. The external differential characters of the two kinds of inflammation are that, in the case of the deposition of lymph, the mucous membrane has a greater degree of density, a lighter shade of colour, and frequently an irregular, lobulated surface; whilst when serum is interstitially effused as the consequence of inflammation, the tumid parts are softer and smoother, have a more fluctuating feel, and generally, also, a deeper colour.

The sub-mucous cellular tissue of the larynx is occasionally the subject of œdema, in consequence of inflammation primarily affecting its texture. The mucous membrane, in such cases, exhibits no alteration of colour or general appearance; the serous effusion is confined to the meshes of the cellular substance, from which it

¹ Gendrin, *Hist. Anat. des Inflammations*, tome i. p. 545.

slowly and gradually escapes when incisions are made into the œdematous parts.

Partial or universal congestion of the air-passages may occur either idiopathically, or as a consequence of diseased heart, of typhus fever, or of other debilitating diseases. It is distinguished from the effects of inflammation by the colour, which is a brownish purple, and by the absence of deposition of any kind in the sub-mucous cellular tissue, or in the membrane itself.

Ulceration of the mucous membrane is by no means an infrequent consequence of inflammation. Ulcers may form either upon the epiglottis, where they usually attack the posterior or laryngeal surface, within the cavity of the larynx, or upon the lining membrane of the trachea. There is no part of the larynx free from the ravages of ulceration; if it occur as a sequel of acute inflammation the ulcers are more frequently found upon the lips of the glottis and the upper parts of the larynx generally, and their edges are of a rounded form and of a red colour. If the ulcers are induced by irritation in a distant part of the same surface, as in phthisis, they are oftener found on those portions of the mucous membrane that are united by a dense cellular structure to the parts beneath, as over the cricoid cartilage, on the vocal cords, and on the laryngeal surface of the epiglottis; though in the trachea a different result is observed, for in this organ ulceration more frequently attacks the membrane which covers the posterior muscular structure than any other part of its circumference. Aphthous and venereal ulcers of the larynx are oftener found upon the upper regions of the larynx, as they spread by continuity of surface from the pharynx; they are broad and shallow, with irregular edges and a sloughy base.

In the early stages of ulcers of the larynx, the bottom of the sore is formed by the sub-mucous tissue; in the course of time this becomes destroyed, and the subjacent organs form the base of the ulcer; this is most usually observed upon the epiglottis, the vocal cords, and the thyroid cartilage.

The ulcers heal by a contraction of the edges of the sore, and never, I believe, by granulations. The cicatrix of a wound or an ulcer in the mucous membrane of the air-passages presents ordinarily a wrinkled, stellated appearance, as if the parts adjacent to the sore had been pulled towards its centre. If the ulcer has been large, the mucous membrane is neither reproduced nor is the secreting surface renewed by any means, and the parts beneath the cicatrix are covered by a thin film of cellular tissue.

The *secretions* of the mucous membrane become changed by inflammation. They may acquire a greater degree of tenuity, and at the same time an increased acidity; this may be accounted the first effect of inflammatory action. As the inflammation advances the fluid is secreted in smaller quantity and becomes more viscous, till, at the most intense period of the disease, secretion scarcely takes place at all.

Blood is often poured out by the inflamed mucous membrane of the air-passages: it may either be pure, mixed with a greenish mucus, or with coagulable lymph.

The exudation of albuminous fluid and the formation of false membranes are other effects of inflammatory action upon these surfaces, and they depend more upon the character than the intensity of the inflammation; for they are attended sometimes by the slightest blush of redness in the mucous membrane, and at others by such a degree of action as speedily terminates in gangrene.¹

The albuminous concretion, when it first forms, has the appearance of grayish viscid mucus, which rapidly augments in consistence, till ultimately it becomes a tenacious membrane. After the layer of lymph is fully formed, the signs of inflammation in the membrane beneath speedily disappear.

The formation of false membranes upon the mucous surface of the air-tubes may take place at any age, but is a much more frequent occurrence before the time of puberty than after.

A fluid having all the qualities of pus is occasionally secreted by the lining membrane of the trachea, and this occurs independently of any breach of surface. When purulent secretion takes place, the mucous membrane has generally a considerable degree of redness and thickening; but there are on record several well-authenticated cases of purulent expectorations going on constantly for a length of time before death, although, on dissection, the mucous membrane presented no perceptible lesion, not even a blush of redness.²

¹ Gendrin, *Hist. Anat. des Inflammations*, tome i., p. 609.

² Andral's *Pathological Anatomy*, translation, vol. ii., p. 482.

DISEASES
OF
THE LARYNX AND TRACHEA.

INFLAMMATORY DISEASES.

CHAPTER V.

ACUTE LARYNGITIS.

Acute laryngitis belongs to that class of diseases that have received the generic name of cynanche, or quinsy; diseases that have been known and distinguished from the earliest ages. The present species was, in all probability, confounded with the other forms of cynanche, and, in fact, could not be identified and separated from them till the cultivation of pathological anatomy had enabled medical observers to discover the reason of the exceedingly grave character of the symptoms, and of the rapid fatality with which quinsy occasionally exhibited itself. The publication of a paper upon the *Angine Laryngée Edemateuse*, by Bayle, in France, and of another paper by Dr. Baillie, in the third volume of the *Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge*, in England, attracted considerable attention to the disease in both countries; and subsequently the medical periodicals have furnished sufficient evidence that the affection in question, though previously confounded with the commoner varieties of quinsy, is not so rare as was at first supposed.

Acute laryngitis is, perhaps, the most formidable of the inflammatory diseases to which the human frame is liable. The suddenness of the attack in most instances, the exceedingly distressing nature of the symptoms, and the rapidity of its progress, concur to place it thus high in the scale of those morbid affections for the relief of which the most potent and energetic resources of the medical art are imperiously demanded.

The general characters of the disease are, an alteration of the

voice, which becomes raucous and hoarse in the first instance, sharp and hissing as the disease advances, and toward its last periods totally extinguished; a short, painful, and sometimes convulsive cough; soreness and a sense of constriction about the laryngeal region; and a constantly increasing difficulty of breathing, exacerbated by the occasional occurrence of spasm of the glottis, and, if unchecked, terminating in suffocation.

Cruveilhier¹ divides laryngitis into two varieties, according as the diseased action is more conspicuous upon the surface of the mucous membrane of the larynx or upon the sub-mucous cellular tissue. To the former he has given the name of *laryngite muqueuse* (mucous laryngitis), the latter he has denominated *laryngite sous-muqueuse* (sub-mucous laryngitis), a disease which Bayle has so accurately described under the title of œdema of the glottis, and which from other authors has received the name of *laryngitis œdematosa*.

The first variety, the true acute or catarrhal laryngitis, frequently commences with symptoms similar to those of cynanche tonsillaris, viz. sore throat, difficulty of swallowing, and general fever, and, like other inflammatory affections, is preceded by rigors. At an uncertain period after the ingression of the attack, pain of a dull character is felt at the upper and front part of the throat, attended with a feeling of constriction; the larynx is found to be sore on pressure; there is slight but frequent cough, unaccompanied by any expectoration; voice harsh and sharp. An examination of the fauces shows them, in most instances, to be inflamed, and very often, by pressing the tongue as much as possible downwards and forwards, the epiglottis may be seen erect, thickened, and of a deep red colour. Besides these, which may be considered as the local signs of acute laryngitis, there are present thirst, great heat of skin, and a full and rapid pulse, which evince the existence of inflammatory fever. The symptoms that succeed are all indicative of an obstruction to the passage of the air into the lungs in the first instance, and afterwards of an imperfect arterialisation of the blood. The respiration becomes impeded and laborious, the act of inspiration requiring an unusual muscular effort, whilst expiration is at first accomplished with comparative facility. As the disease advances and the aperture of the glottis becomes narrower, the symptoms of strangulation come on with frightful rapidity: the countenance is flushed and extremely anxious—the eyes starting from their sockets—the lips livid—respiration can scarcely be performed—the voice is gone—the pulse weak and intermitting—the patient sits upright in bed, with open mouth and outstretched neck, grasping the bed-clothes to assist him in drawing his breath, or throws himself across the bed in the attitude, and with the feelings, of despair. Muttering delirium, followed by coma, is generally an attendant at the close of life.

¹ Diction. de Méd. et de Chirurg., art. Laryngite.

The duration of the disease is usually from three to five days; but of course the constitution of the sufferer, the degree of intensity of the inflammatory action, and the activity of the treatment employed, will all act as modifying circumstances. Laryngitis has proved fatal in less than twenty-four hours; and again the acute form of the disease has lapsed into the chronic, and thus the period of suffering has been considerably extended. Those cases terminate most rapidly, and, consequently, are the most to be dreaded, in which the larynx is the organ primarily affected, and in which the signs of inflammation in the fauces are seldom exhibited. Of this kind was the case of General Washington,¹ who, after being exposed to rain during the 10th of December, 1799, was seized some time in the following night with shiverings, accompanied with pain in the upper and fore part of the throat, and a sense of stricture in that part, which were soon succeeded by fever and a quick and laborious respiration. He had no pain in swallowing, nor is any mention made of redness or swelling of the fauces or pharynx. The illustrious patient died within twenty-four hours from the commencement of the attack.

Tacheron² relates a case which, as an excellent example of pure laryngitis, I shall take the liberty of transcribing almost verbally.

CASE I.

A woman, aged 39, of a weakly constitution, was seized with violent headache, during the night of May 13, 1812. In the morning of the 14th, she was brought to the hospital with the following symptoms: great anxiety and agitation, inability to lie down, eyes bright and sparkling, countenance flushed, tongue red, suffocation imminent, voice sharp: she had at the same time a burning pain in the region of the larynx, augmented by deglutition and by pressure; it was impossible to raise or depress the larynx without giving the patient most acute pain. In examining the interior of the mouth, and especially the posterior part of this cavity, no alteration in the colour or the volume of the parts contained therein could be perceived; the pulse was frequent and very intermitting, intellectual faculties troubled, urine high-coloured, skin burning hot. Ten leeches were applied to the throat. At mid-day the respiration was more embarrassed, the mouth open, neck stretched out, and occasionally there was a raucous cough. She died at eight in the evening, apparently from suffocation.

Dissection.—The only morbid appearances were in the larynx. The edges of the glottis were thickened and approached each other; they were covered with a very dense and yellowish layer. The epiglottis was curved upon itself, and its investing membrane was

¹ Cyclop. of Pract. Med., art. Laryngitis.

² Recherches Anat. Pathol., tome i.

of a pale red. The mucous membrane of the larynx was rather reddened, and the trachea and bronchi were filled with mucus.

In this case the laryngitis, which proved fatal in less than twenty hours, was not preceded by any catarrhal affection; the whole force of the disease appears to have fallen at once upon the larynx, for in a very short time from the commencement of the attack, suffocation was imminent and the voice sharp. The treatment was puerile in the extreme, and by no means calculated to arrest the progress of so severe a form of disease.

Mr. Porter¹ relates an example of this disease, in which death took place sooner even than in the case that has just been detailed. He was desired to open the body of a boy who had been found dead in his bed, and in whom there had been so little appearance of illness previous to his retiring for the night that it was suspected he had taken poison. On dissection the epiglottis was found red, erect, and swollen to twice its natural thickness. The mucous membrane of the larynx appeared inflamed as far down as the rima, the sub-mucous tissue was quite œdematous, and on looking down into the larynx it became evident that the tumefaction had absolutely closed up the glottis, and caused suffocation.

Laryngitis generally terminates fatally about the third or fourth day, but when the symptoms are of a mild character it may continue seven or eight days before it occasions death. An instance of this kind is related by Gendrin.²

CASE II.

A woman aged 25, had been suffering from severe cold and sore throat for eight days; when she was brought into the Hotel Dieu the symptoms were those of approaching suffocation, the voice was nearly extinct, pulse strong, and face injected. She died in the night after her entrance into the hospital. On inspecting the body the mucous membrane of the pharynx was of a cherry-red colour; the epiglottis, slightly reddened externally, formed a soft tumour, of the size of a nut. One of the lips of the glottis was so much swelled and infiltrated as to impede the passage of the air into the larynx during inspiration, though it would readily permit its exit during expiration. The mucous membrane of the larynx was of a uniform vivid red, and that of the trachea was dappled with deep red patches, not circumscribed. The fluid with which the epiglottis and lips of the glottis were infiltrated was of a sero-purulent nature.

This last circumstance should be recollected with reference to the duration of the disease; for it has generally been noticed that, when the complaint has terminated rapidly, serum only is effused into the sub-mucous tissue of the glottis, whilst, when its course

¹ Pathology of the Larynx, &c., p. 113.

² Histoire Anat. des Inflammations, tome i., p. 541.

has been more tardy, a sero-purulent fluid is found within the meshes of the cellular structure.

CASE III.¹

An old soldier, aged 56, was seized with symptoms of acute laryngitis: pain in the throat, general fever, respiration extremely difficult, quick, and whistling, with menaced suffocation, voice sharp and croupal. The sufferings of the patient were relieved for a time by antiphlogistic treatment, but in the evening of the fourth day the symptoms returned, together with delirium, and he died at noon of the fifth day.

Dissection.—The mucous folds which form the sides of the superior orifice of the larynx, the mucous membrane which covers the posterior part of this organ, the neighbouring part of the pharynx, the base of the tongue, and the anterior face and superior edge of the epiglottis, were distended by infiltration of pus. The lips of the glottis were enormously tumefied, so as to come into close contact by their inner surfaces, leaving a very narrow channel for the passage of the air. The rima glottidis and all the parts below were in the most natural state.

The following case is singular from its subject being a child of tender years, and also from the existence of ulceration on the surface of the inflamed mucous membrane.

CASE IV.

John Wallis, aged two years and nine months, a fine, healthy child, was seized with measles on the 26th of October, 1834. On the evening of the 29th he was attacked by shiverings, difficult respiration, and hard dry cough. I saw him at mid-day of the 30th: the measles were then fully developed over most of the surface of the body, the child seemed to be labouring under severe bronchitis, there was general fever, cough, and quick respiration. Eight leeches were applied to the chest, and a tartar-emetic mixture given. 31st.—The breathing was easier, but the cough was more frequent, and at the same time very dry and hoarse, like the cough of croup. 1st of November.—The symptoms were precisely those of the last stage of croup, except that there had been no rejection of membranous matter from the trachea. The pulse was weak, extremities cold, respiration quick and sonorous; and at the same time the nostrils were expanded, the shoulders drawn up, the countenance purple and exhibiting deep distress. There was no difficulty of swallowing, the little patient seizing greedily upon any liquid presented to him. The child seldom spoke, but when it did the voice was a kind of hoarse whisper. He died at 12 o'clock the same night, apparently suffocated.

¹ Cruveilhier, Anatomie Pathologique, 5th livraison, plate 2.

Dissection, thirty-four hours after death.—The contents of the chest were perfectly healthy, but the lungs did not collapse when the sternum was removed; the trachea and bronchi were also quite pale and healthy, containing only a little white glairy mucus. The epiglottis stood firmer and more erect than it ordinarily does, and its mucous membrane, both on the upper and under surfaces, was red and much thickened. On its superior or lingual face were two deep ulcers, one of which was as large as a split pea. There were other ulcers, forming a chain, which almost surrounded the superior aperture of the larynx, but more on the pharyngeal than the laryngeal surface of the mucous membrane. The lips of the glottis were considerably reddened, and so much infiltrated that the ventricles of the larynx were nearly obliterated; and the sides of the cavity above the vocal cords were closely approximated to each other. Below the rima there was no trace of inflammatory action.

Remarks.—The disease, in this instance, was not recognised before death, or the performance of laryngotomy at an early period would, perhaps, have restored the child immediately to a state of comfort, and very soon to health; but I was deceived by the strong similarity that the symptoms bore to those of croup, a similarity that was made more striking by the age of the little patient, a stage of life wherein croup often occurs, but in which laryngitis is certainly not to be expected.

The œdematous state of the superior aperture of the glottis, and the inflamed and thickened condition of the epiglottis, sufficiently characterise this case as one of acute laryngitis. The co-existence of ulceration with the infiltrated state of the mucous membrane of the larynx is, I am led to believe, of very rare occurrence, as it has been mentioned by very few of the authors that have written upon the subject, as far, at least, as I have examined them. Cruveilhier¹ mentions two cases in which ulceration in some part of the larynx was found after death from acute laryngitis. In the first of these, a young man affected with measles was, during their continuance, attacked by laryngitis, and died in eight days from its invasion. The lining membrane of the larynx was red and thickened, and over the base of one of the arytenoid cartilages was a small loss of substance. In the other case, the same author found the whole internal surface of the larynx covered with small superficial ulcerations. Dr. Cheyne² also records the dissection of a case of laryngitis occurring after measles, in which the epiglottis and glottis were found considerably thickened, "and below the sacculus ulceration had taken place."

Diagnosis.—There are few diseases with which acute laryngitis is at all likely to be confounded, for the distinctive symptoms of this affection stand out in so prominent a manner that they leave

¹ Diction. de Médecine, &c., art. Laryngite.

² Dictionary of Practical Medicine, art. Laryngitis.

little room for doubt, either as to the situation or the character of the morbid changes that produce them.

The situation of the disease is indicated by the pain and soreness in the laryngeal region, by the sense of constriction, and by the difficulty with which the act of inspiration is accomplished. The dyspnœa attendant on a constricted state of the aperture of the glottis cannot be mistaken; in asthma the difficulty of inspiring is frequently as great as in the latter stages of laryngitis, but there is no feeling of constriction about the larynx, no drawing down of this organ with each inspiratory effort; and though the respiration in both diseases is attended by unnatural sounds, their character is perfectly distinct. In laryngitis, when fully developed, the drawing in of the breath is accompanied by a stridulous or hissing noise, whilst in asthma the noise more resembles the cooing of a dove, and obviously results from the constriction of many tubes instead of one only.

A foreign body in the larynx will produce many of the symptoms of inflammation of this organ, but the suddenness with which the dyspnœa commences, the difficulty which equally attends both the acts of inspiration and expiration, and the absence of fever at the commencement, are characters sufficiently distinctive.

Difficult deglutition, frequent and convulsive cough, alteration of the voice, and soreness in the laryngeal region, when combined, prove indisputably the existence of disease in the larynx, and its chronic or acute nature may be decided by the length of time the symptoms have been present, and by the degree of fever with which they are accompanied. The voice is frequently not much altered at the first outset of acute laryngitis, but towards the termination of life it is either reduced to a whisper or entirely suppressed. As the disease seems to expend itself chiefly on the superior aperture of the glottis, the action of the vocal cords is not interfered with in many cases, till the thickened state of the lips of the glottis prevents the air passing with sufficient force or in volume enough to actuate the vocal apparatus.

Frequency.—Happily this formidable disease is not one of very frequent occurrence: the fact of its being almost unnoticed and unrecognised till the publication of Dr. Baillie's cases in the *Transactions of the Medical and Chirurgical Society* is sufficient proof of this; and although since that time numerous instances of laryngitis have been recorded in the medical journals, this may, in some measure, have arisen from its being a new disease, and from the anxiety of the members of the profession to add to the stock of information with regard to the effects of remedies in a complaint which has so often baffled the efforts even of the most skilful.

Causes.—The causes of laryngitis are similar to those that produce the other inflammatory affections of the air passages, such as exposure to cold and wet, suppressed perspiration, great vocal exertions, &c. And the cases recorded seem to indicate that those persons who are subject to attacks of cynanche tonsillaris are more

liable than others to suffer from the disease under consideration. This may arise either from a predisposition in the individual to inflammation of the parts in the neighbourhood of the fauces, or from the extension of the morbid action always present in quinsy along the surface of the mucous membrane from the back of the mouth to the larynx.

Has the age or sex of the patient any influence in predisposing to this disease? Laryngitis without effusion of coagulable lymph is a disease almost peculiar to adults; there are very few cases on record in which it has attacked children or persons under the age of twenty.

The following table shows the respective ages of twenty-four persons who have suffered from attacks of laryngitis; only two of them were under the age of twenty, four between twenty and thirty, six between thirty and forty, five between forty and fifty, three between fifty and sixty, and four between sixty and seventy. Nine of the patients only were under the age of thirty-five, and fifteen between that age and seventy, giving a large preponderance in favour of the latter periods of life.

TABLE.

	REFERENCE TO THE CASES.	SEX.	AGE.	RESULT.
1	Howship's Pract. Observ., &c., p. 150.	Male	17	Died 3d day.
2	Porter's Pathol. of Larynx. &c., p. 111.	—	19	— 1st day.
3	Cruveilhier, Dict. de Médecine, &c.	—	20	— 8th day.
4	Wilson, Med. Chir. Trans., vol. v.	—	24	Cured.
5	Hill, Edin. Med. and Surg. Journ., v. xii.	Fem.	24	—
6	Gendrin, Hist. Anat. des Inflam.	—	25	Died 8th day.
7	Lancet for 1827—8.	Male	30	Cured.
8	White, Dub. Hosp. Rep., v. iv.	—	33	—
9	Wood, Med. Chir. Trans., v. xvii.	Fem.	33	—
10	Farre, Med. Chir. Trans., v. iii.	Male	38	Died 4th day.
11	Tacheron, Recherch. Anat. Path., t. i.	Fem.	39	— 1st day.
12	Hill, Edin. Med. and Surg. Journ., v. xii.	—	36	— 4th day.
13	Hill, Edin. Med. and Surg. Journ., v. xii.	Male	40	Cured.
14	Wood, Med. Chir. Trans., v. xvii.	—	40	Died 3d day.
15	Roberts, Med. Chir. Trans., v. vi.	—	45	Cured.
16	Abercrombie, Ed. Med. and Surg. Jour., xii.	Fem.	45	—
17	Porter, Pathol. of Larynx, &c.	Male	47	Died 1st day.
18	Abercrombie, loc. cit.	—	50	— 4th day.
19	Cruveilhier, Anat. Pathol.	—	56	— 5th day.
20	Baillie, Trans. of Med. and Chir. Soc. }	—	59	— 3d day.
21	v. iii., p. 275. }	—	60	— 4th day.
22	Howship, Pract. Observ., &c., p. 150.	—	60	— 3d day.
23	Farre, Med. Chir. Trans., v. iii.	—	62	— 4th day.
24	Cyclop. Pract. Med., art. Laryngitis.	—	68	— 1st day.
25	Percival, Med. Chir. Trans., v. iv.	—	?	— 6th day.
26	Arnold, Med. Chir. Trans., v. ix.	—	?	Cured.
27	Martin, Phil. Trans. of 1730.	—	?	—
28	Lond. Med. and Phys. Journ., v. xxxii.	—	?	Died 2d day.

With regard to the influence of sex it is not possible to arrive at any determinate conclusion, owing to the paucity of facts; hitherto the number of recorded instances of males attacked by this disease is very great in comparison with that of females, viz., as twenty-two to six in the twenty-eight cases referred to in the table, which cases were taken indiscriminately from various books. This may be accounted for, perhaps, by the greater exposure to variations of temperature and weather incident to the more active mode of life of the stronger sex.

The mortality of this disease is great; of the twenty-eight cases in the table eighteen died and ten recovered, but this, I fear, gives too favourable a view of the usual termination of acute laryngitis, and is to be accounted for by the disposition of mankind to vaunt of their success and conceal their failures.

Death occurred within the first twenty-four hours in four of the cases, on the second day in one, on the third day in four, on the fourth day in five, on the fifth day in one, on the sixth day in one, and on the eighth day in two of the instances.

Twelve of the twenty-four patients, whose ages are recorded by the narrators of the cases, were under forty years of age, and the other twelve were above that age; of the former, seven died and five were cured, whilst of the latter nine died and three only recovered.

Pathology.—An examination of the bodies of persons who have died of laryngitis brings to view a tolerably uniform class of morbid appearances, which are amply sufficient to account for the symptoms that have occurred during life. The effects of the disease are more evident upon the superior and external parts of the larynx than upon the internal; the epiglottis, for instance, and the lips of the glottis, always exhibit the marks of inflammatory action, whilst the mucous membrane lining the larynx is, in some instances, pale and healthy.

The usual post mortem appearances are an inflamed and thickened state of the epiglottis, this organ standing erect, so as to leave the cavity of the larynx quite uncovered; and upon a more strict examination the increased thickness of the epiglottis is found to be produced chiefly by infiltration of the sub-mucous tissue. The edges of the superior orifice of the larynx, which are formed by the fold of mucous membrane that connects the summits of the arytaenoid cartilages with the epiglottis, are likewise reddened in various degrees, and so much infiltrated with a serous, a sero-purulent, or a purulent fluid, as to obstruct, in a manner more or less complete, the entrance into the larynx. The disease generally affects both these folds equally, but in some instances only one of them is found to have suffered. In some cases the disease expends itself entirely upon the epiglottis and the lips of the glottis, but generally there is some degree of redness and an œdematous state of the parts of the larynx situated below the rima.

When laryngitis has proved rapidly fatal, the lips of the glottis are much reddened and infiltrated with limpid serum; but when

the disease has been less prompt in its effects the infiltrated fluid is sero-purulent,¹ and in some rare cases purulent.² Ulceration of the mucous membrane may also occur,³ but this is a very infrequent termination of *acute* laryngitis; and occasionally coagulable lymph is effused on the inflamed membrane, particularly about the edges of the glottis (Tacheron's case⁴ is an example of this, and likewise Dr. Farre's second case⁵); but this appears upon the whole to be an unusual occurrence, and is probably to be ascribed to the great intensity of the inflammation.

The inflamed and erect state of the epiglottis fully accounts for the difficulty of swallowing; this organ affords, in fact, a mechanical obstruction to the passage of the food, and at the same time leaves the cavity of the larynx exposed to contact with the passing aliment at a time when the inflamed condition of its muscles incapacitates them from acting with their accustomed energy.

One of the most important differences between the pathological effects of acute laryngitis and œdema of the glottis is, that, in the former disease, the epiglottis is always found more erect than natural, redder in colour, and thickened, in various degrees, by the infiltration of serous or sero-purulent fluid; whilst in the latter disease it never exhibits any degree of redness, and very seldom any augmentation of bulk. Serous deposition in the sub-mucous tissue of the larynx is, as we have already seen, by no means peculiar to œdema of the glottis; it has, in fact, been found in every fatal case of acute laryngitis, but combined with the usual pathological signs of active inflammation; so that, in respect of the sub-mucous infiltration, the degree in which it occurs, considered with relation to the presence or absence of a red and thickened state of the mucous membrane itself, must determine us under which head we should place any particular case that comes under our observation.

Nature of the Disease.—Laryngitis consists essentially in an inflammation of the mucous membrane of the larynx and epiglottis, and, we may add also, of the sub-mucous cellular tissue of these organs, for this tissue, from its close connection with the mucous membrane, and from the identity of their blood-vessels, generally participates in the disease. A sub-acute form of laryngitis, in which the surface of the mucous membrane only is affected, may be said to accompany almost every attack of bronchial catarrh, but the increase in the action of the vessels is so slight that the sub-mucous tissue remains unchanged, there is, consequently, no obstruction to the passage of the air through the glottis, and when secretion from the surface of the membrane commences, the vessels are soon relieved from their state of congestion. The extreme danger attendant upon acute laryngitis is to be ascribed, 1st, to the simultaneous affection of the substance of the mucous membrane and the

¹ Case II., p. 29.

² Case III., p. 30.

³ Case IV., p. 30.

⁴ Recherch. Anat. Path., tome i.

⁵ Med. Chir. Trans. vol. iii.

sub-mucous structure, both of which acquire a great increase of bulk when they become the subjects of inflammation; and, 2d, to the seat of the disease—the glottis. The narrowness of the rima, and the laxity of the sub-mucous cellular structure which forms so large a part of the lips of the glottis, are the chief causes why inflammations of the larynx are so speedily destructive to life; for in a very few hours after the commencement of the disease, the thickening of the lining membrane and the infiltration of the cellular tissue are sufficiently great to intercept the passage of the air in respiration.

In many cases of laryngitis, there are accesses of suffocation, followed by remissions, during which the respiration is comparatively tranquil: these exacerbations are occasioned by a spasmodic action of the muscles that close the glottis. This circumstance adds considerably to the patient's sufferings, and no doubt occasionally causes his death. It is not easy to account for the occurrence of spasm, but it almost always manifests itself during the inflammatory diseases of the larynx, and appears to depend on a morbid excitability of the muscles of the glottis, induced either by what is called sympathy, or perhaps by an extension of the inflammation to the muscles themselves.

The urgent and frightful symptoms of acute laryngitis depend, not upon the simple circumstance of inflammation existing in the mucous membrane of the glottis, but upon the obstruction caused by it to the passage of the air in respiration, and the consequent reaction of the whole system. The comatose state that so frequently supervenes in the last moments of life, is attributable to the same cause. Owing to the obstructed condition of the breathing, the lungs become gorged with venous blood and infiltrated with serum; an imperfectly arterialised fluid is circulated through the vessels of the brain, and stupor terminating in coma speedily ensues.

Symptoms of suffocation come on before the passage of the air is completely intercepted by the thickened state of the glottis; and this may be owing in some measure to a spasmodic action of the muscles of the part, but more particularly to the congestion of the mucous membrane of the bronchial ramifications, which there is every reason to believe will put a stop to the functions of the lungs: the phenomena of asthma, and of dyspnœa from obstruction to the pulmonary circulation in consequence of diseased heart, afford illustrations of this fact in pathological physiology.

Treatment.—That laryngitis partakes of the nature of acute inflammation, no one can for a moment doubt; and, moreover, from the locality of the disease and its rapid progress, the most energetic antiphlogistic treatment can alone afford even the slightest chance of a happy termination. The history of this affection shows but too plainly how vain and ineffectual are the usual means resorted to for arresting its progress. "Unhappily," as Dr. Farre observes,¹ "the necessary time can rarely be obtained in this disease, in which the activity of the inflammation is expended on a small but most

¹ Med. Chir. Trans., vol. iii. p. 327.

vital seat; for the glottis once narrowed, may be closed by the local action, even after the general powers are prostrate."

Considering the nature of the complaint, together with the mature age at which persons are usually attacked by it, there can be little doubt of the propriety of bleeding, as a general rule, though the employment of this remedy must undergo modifications according to the age and constitution of the patient, and the period of the disease. By the period of the disease, I do not refer, of course, to mere lapse of time, which would be a consideration likely to lead to very erroneous results—but to the progress that has been made towards suffocation, which is the common effect of the unchecked inflammatory action. At the commencement of the attack, when the chief symptoms are pain and a sense of constriction in the larynx and accelerated circulation, a full bleeding, carried to such an extent as to produce an approach to syncope without absolute fainting, should be tried. The force of the heart's action having been diminished by this means, the seat of the inflammation should be immediately attacked by a number of leeches crowded all over the upper and front part of the neck, for the purpose of draining the vessels of the larynx, whilst the reaction of the system is prevented as much as possible by the exhibition of depressing medicines, such as mercury and tartar-emetic. If this plan, executed promptly and with vigour, fail in relieving the patient, recourse should be had instantly to bronchotomy, for nothing else seems to afford a reasonable chance of success, and the probability of this operation giving relief becomes smaller every hour it is delayed. Dr. Baillie¹ proposed the operation in the case of Sir J. M. Hayes, but before it could be performed the patient was beginning to sink. Sir A. Cooper did the operation at Dr. Farre's request² (Case II.) in one instance, but at such a period of the disease as that little benefit could have been expected: the patient is described as in a state of impending suffocation, with face collapsed, pulse small, and powers altogether prostrate. The dyspnœa was relieved by the operation, but the man sank and expired sixteen hours afterwards.

The published records of cases of laryngitis show but too evidently that this operation has seldom been performed soon enough to afford well grounded expectations of relief; for when the disease has continued some time, the lungs become gorged with venous blood, serum is effused into their reticular texture, and an emphysematous condition is likewise induced in them. The brain suffers probably from the nature of the blood circulated through its vessels, and gradually loses the power of controlling the functions of the body and exercising its own. The consequence is such a state of exhaustion of the vital powers, that reaction and recovery cannot take place when the respiration is rendered free by means of laryngotomy.

¹ Trans. of Med. and Chir. Society, vol. iii.

² Med. Chir. Trans. vol. iii.

Taking into consideration, therefore, the rapid course of the disease, the extreme difficulty with which any impression can be made upon it by the remedies at present known, and the irreparable mischief done to important organs during its continuance, we cannot hesitate in insisting on a very early performance of the operation in question. Bronchotomy is not a cure for laryngitis, it is to be viewed simply as a means of arresting the tendency to death which in this disease is so strong; it gives opportunity for the action of remedies, which will seldom fail to cure, if sufficient time be given them to produce their effects.

This operation, to be of any service, should never be delayed an instant when the attacks of impending suffocation seize the patient; for that period of the disease soon arrives, in which the respiratory and circulatory functions are so disordered that the re-establishment of the passage for the air, which, a few hours previously, would have completely renovated the powers of the patient, can do no more than relieve the labour of breathing, and prolong life for a few hours, or for a day or two. A short time after the performance of the operation under these unfavourable circumstances, the patient falls into a state of stupor, from which nothing will rouse him.

"As long as bronchotomy is considered as an extreme measure, a *dernier ressort*, it will always be performed too late in this disease," observes M. Louis.¹ Mr. Porter² says, "I have witnessed some operations in cases of acute laryngitis, and as yet I have never seen one successful; and I would attribute this, not to the severity of the affection or to the inadequacy of the operation to procure relief, but solely to the circumstance of a considerable portion of time being previously employed in trying to subdue it by the usual measures of combating inflammation, and the use of the knife being thus postponed till a period when it was only tried as a last resource, and could by no means promise even a probable chance of success."

Mr. Lawrence³ also advocates the early performance of bronchotomy in cases of this disease. He says it should be done "as soon as the symptoms enable us to determine the nature of the disease. In no case is delay more dangerous."

Tartar-emetic and mercury combined, or mercury by itself, would be well worth a trial in this disease, if we could be sure of a sufficient length of time for them to produce their peculiar effects, but this can seldom be calculated on. If, however, a case should occur in which, from local circumstances, or from the refusal of the patient, bronchotomy cannot be performed, mercury, exhibited both by the mouth and by the skin, should be had recourse to immediately, for it certainly possesses an extraordinary power of diminishing the action of the secernent, and exciting that of the absorbent vessels; and as death seems, in most instances, to be owing to the effusion of

¹ Mémoires de l'Acad. de Chir., tome iv., p. 431. 8vo edit.

² Pathology of the Larynx, p. 110.

³ Med. Chir. Trans., vol. vi., p. 234.

serum into the sub-mucous cellular tissue of the lips of the glottis, the full action of this remedy would, in all probability, put a stop to the disease. On these grounds, mercury should be given after bronchotomy has been performed, unless it is contra-indicated by the condition of the patient.

Blisters and other counter-irritants have been extensively used as remedial means for arresting the progress of laryngitis, but with no such decided success as to warrant a recommendation of them, more especially as their employment renders the operation of tracheotomy more difficult of performance, by causing an inconvenient degree of tumefaction in the front of the neck.

Scarification of the tonsils is recommended by Celsus, and may be worth a trial in those cases where much inflammation of the fauces is present; no instances, that I am aware of, are on record in which this plan has been carried into effect.

Tartar-emetic, as a means of diminishing the activity of the general circulation, has been mentioned as an adjuvant of some promise, but the giving it with intent to produce actual vomiting appears to me to deserve reprobation; for, considering the anatomical character of laryngitis (I refer particularly to the permanently erect state of the epiglottis), the fluids ejected from the stomach during its emetic action will, in all probability, either enter the larynx or produce so much spasmodic action of the muscles of the glottis as absolutely to endanger life.

Opium has been of service as a palliative remedy, though it can have but little curative tendency; it diminishes the spasm of the muscles of the glottis—a symptom productive of great distress—and, by procuring rest and sleep, causes the act of respiration to be less frequently performed.

Bronchotomy was performed in six of the cases that are referred to in the Table,¹ and in four of them a cure was obtained; but in the remaining two temporary relief only was the result. In the successful cases the operation was done on the second day once, on the third day twice, and on the fifth or sixth day once. In the unsuccessful cases it was done on the second and third days.

The treatment that effected a cure in the other six instances in which recovery took place, was vigorously antiphlogistic, and consisted of large bleedings, general and local, blisters, and calomel; but in other instances the same remedies, applied with equal energy, utterly failed in effecting a cure.

From these facts we may draw the conclusion, that the ordinary antiphlogistic treatment, though strenuously urged, most frequently fails, and that bronchotomy affords a much better chance of success, even when done at a late period of the disease.

¹ Page 33.

CHAPTER VI.

ŒDEMA OF THE GLOTTIS.

The term œdema of the glottis has been applied to that variety of laryngitis in which the sub-mucous tissue of the superior part of the larynx is rendered œdematous by the inflammatory process, whilst the external surface of the mucous membrane is at the same time free from any signs indicative of the existence of inflammation. The acute or catarrhal laryngitis is always attended by a greater or less degree of sub-mucous infiltration, owing to which circumstance, the name œdema of the glottis has been given in numerous instances to cases of this disease, observers not having discriminated between the serous infiltration which takes place subsequent to, and in consequence of increased action in the vessels of the mucous membrane above, and that which originates in the sub-mucous cellular tissue itself.

The disease is characterised by a constant and increasing impediment to respiration, the act of inspiration being always attended with difficulty and distress, whilst expiration is performed with freedom; by a feeling of constriction in the larynx, and of impending strangulation, as if the upper part of the windpipe were closed by some foreign body in that situation;¹ by the state of the voice, which is at first hoarse, then sharp and hissing, and afterwards croupy; by a dry, hoarse, and convulsive cough, and by the occurrence of frequent accesses of suffocation, during which the distress and agitation of the patient are beyond description. There is very little pain or difficulty in swallowing, scarcely any soreness on pressure in the laryngeal region, and no fever.

The ordinary duration of this disease is from two to five days; sometimes, however, it terminates fatally in a much shorter period of time, the first symptoms being those of impending suffocation, caused partly by a rapid infiltration of the lips of the glottis, and still more by a spasmodic action of the muscles which close the rima. Most commonly the first indications of the existence of œdema of the glottis are a sense of uneasiness in the larynx and a continual effort on the part of the patient to expel, by means of a forcible expiration, mucus or other matters which appear to him to be clogging the laryngeal aperture; he also frequently endeavours, by repeated attempts at deglutition, to disembarass the upper part of the throat of some extraneous body which he imagines to have lodged in that situation. The voice is, at the same time, rather hoarse, but respiration remains for the present unimpeded. In the course of a few hours, or of two or three days, according to the rapidity with which the disease advances, the voice becomes hoarser,

¹ Cruveilhier, Dict. de Méd. Prat., art. Laryngite.

or sharp and stridulous, and there is occasional difficulty of breathing, more particularly in the act of inspiration; this is not permanent, however, but is succeeded by strong expiratory efforts, which, by expelling a little glairy mucus, soon render the respiration tolerably free. If the disease remain unchecked, the dyspnœa in a short time becomes permanent, or offers only slight remissions; the patient sits upright in bed, with the head thrown back, the shoulders elevated; and the whole of the respiratory muscles convulsively engaged in endeavouring to draw air into the chest, whilst the power of expelling the air with facility still continues. The almost constant dyspnœa is aggravated from time to time by accesses of suffocation, which occur more frequently as the obstruction to respiration increases, and the patient dies either in one of these attacks, or, as more commonly happens, in the intervals between them, when we should expect that the air, by penetrating into the chest, would reanimate and restore him.¹

In the early stages of this disease the general health is not in any way deranged, unless it be already suffering from the simultaneous existence of some other malady; the state of the skin and of the pulse give no indications of fever, and the appetite remains unimpaired. When, however, the tumefaction of the lips of the glottis affords a serious hindrance to the function of respiration, the pulse becomes hurried and ultimately intermitting, the intellectual faculties are troubled, and the whole system exhibits the greatest disorder.

The following cases illustrate the usual progress and termination of œdema of the glottis:—

CASE I.

November 16, 1836. Mr. Bass, a young plethoric man, subject to quinsy, had an attack of scarlatina about a fortnight since; the tonsils were inflamed and covered with spots of ulceration; he soon became convalescent and went to business.

On the 14th of November, he exposed himself for a whole day in a cold warehouse, and during the night he was affected with hoarseness, a sense of fulness in the throat, and difficult deglutition. In the evening of the following day, the symptoms were aggravated; there was stertorous breathing, inability to swallow, difficult but distinct articulation, soreness on the sides of the thyroid cartilage when pressed; no tonsillitis, nor any external enlargement.

On the succeeding morning, there was great oppression, inability to swallow even a drop of liquid, stertorous breathing increased, voice an audible whisper. He died suddenly, soon after the morning visit, thirty-six hours from the commencement of the attack.

Dissection, eight hours after death.—The larynx was completely closed, owing to the œdematous state of the sub-mucous tissue of

¹ Bayle, Diction. des Sciences Médicales, art. Œdème de la Glotte.

the lips of the glottis, and the ventricles of the larynx. The œdema was much greater on the right side than on the left. The surface of the mucous membrane was smooth and devoid of vascularity, except on the upper part of the right arytaenoido-epiglottic ligament, where was a small ulcer with vascular edges. The larynx below the rima was quite healthy. The epiglottis stood up firm and immovable; it was natural in colour, but very much thickened, and its surface was irregular. When cut into, the increased bulk was found to be owing to albuminous deposition within the sub-mucous cellular structure of the organ. There were no marks of inflammation in the tonsils or pharynx.

Remarks.—A thickened and indurated state of the epiglottis, together with an absence of apparent vascularity, are generally signs of the pre-existence of a chronic inflammation in the part; yet no symptoms of such an affection were present in this case, the patient having enjoyed a perfect state of health between the time of his convalescence from scarlatina and the laryngeal attack. We should expect that chronic inflammation of the epiglottis would be attended by difficult deglutition and an altered condition of the voice; but as far as I can ascertain, no such symptoms were present. About the cause of death, there can be no doubt: the sub-mucous infiltration was sufficient to close, almost completely, the cavity of the glottis. The infiltrated fluid was of a serous nature, and was deposited within the meshes of the cellular tissue; for after cutting into this part, it continued slowly to exude for several hours, till the mucous membrane of the glottis became quite flaccid, and the cavity of the larynx was restored.

The function of deglutition was more impaired than it generally is in cases of œdema of the glottis, and the fact admits of complete explanation by the state of the epiglottis. It is not easy to point out exactly the cause of the disease, but it was probably a combination of three circumstances that have been mentioned; viz. the morbid state of the epiglottis, which *must* have existed for more than thirty-six hours previous to death—the disposition to attacks of quinsy—and the exposure to cold in an open warehouse soon after convalescence from scarlatina.

CASE II.

William Wilcox, aged 41, a groom, of temperate habits, was engaged, in March, 1835, in skinning a horse which had died of *glanders*. On the previous day he had run a thorn into the palm of the left hand, and he supposed that matter from the dead horse had come into contact with the sore. On the following day the hand was swollen, inflamed, and excessively painful; continued so for five weeks, when the inflammation suddenly receded from the hand and made its appearance on the inner side of the arm, a little above the elbow. In a few days it disappeared from the arm, and the thigh and calf of the right leg were similarly affected; these

remained inflamed for some time, but in October he recovered completely and returned to his work.

In January, 1836, the same local inflammatory affections recommenced, and the right shoulder, the ankle, the knee, and the elbow, were consecutively attacked. On the 12th of July, at which time he was under the care of Dr. James Johnstone, as an in-patient of the Birmingham General Hospital, his state was as follows:—Slight swelling and undefined erythematous redness about the right elbow, a sharp and gnawing pain in the knee, which is very tender on pressure; absorbents on the inner side of the thigh inflamed; great anxiety of countenance, flushed cheeks, tremulous action of the muscles, hurried respiration, pulse 120, small and weak, thirst, and foul tongue.

21st. Regular nocturnal delirium; muscular tremor almost constant; there is a wild and exhausted expression of countenance; pulse 136, weak and fluttering. 23d. Muttering delirium night and day, constant tremors, pulse 140, skin hot and dry. Respiration much accelerated and accompanied with a loud sound. At 5 P. M. of the same day the respiration was very much hurried, and each inspiration was attended with a crowing noise audible at a considerable distance. Pulse small and very rapid, profuse perspiration, lips blue. No tenderness of the larynx on pressure. He continued in this state till 10 o'clock, when he died suffocated.

Dissection, eleven hours after death.—Body muscular and rather fat. The periosteum of the tibiæ was thick, soft, and easily detached from the bones, and within its substance abscesses were found. All the glands of the body were healthy.

Head.—A very vascular gelatinous membrane was found within the arachnoid, on the surface of the brain, but more adherent to the dura mater than to the convolutions. The brain throughout was firm, and had a slight pinkish mottled appearance.

Throat.—The orifice of the larynx was almost closed by a yellow, semi-transparent, œdematous swelling of the sub-mucous tissue of the lips of the glottis; the œdema extended also to the cellular tissue beneath the mucous membrane which covers the posterior part of the larynx and to the right tonsil, but the epiglottis was unaffected. Several vessels were seen penetrating the anasarcaous tissue and ramifying in a very beautiful manner as they approach the surface. The mucous membrane lining the cricoid cartilage for the space of half an inch was of a light-green colour, inclining to violet, and covered with many yellow dots, where purulent matter was advancing to the surface, and in some situations the membrane was perforated and pus escaped. On cutting through the mucous membrane, the sub-mucous tissue was found infiltrated with grayish pus. The inner surface of the cricoid cartilage was converted into a ring of bone, which was loose and carious, and in contact with the pus. The trachea, bronchi, and lungs were healthy.

Remarks.—It is not my intention to examine into the connec-

tion that may have existed, in this case, between the inoculation of the hand with the matter of glanders, and the subsequent formation of inflammatory swellings in various parts of the body. But if these local phlegmasiæ and the abscesses found in the periosteum of the tibiæ, originated in the absorption of a specific virus, it is fair to conclude that the morbid condition of the cricoid cartilage was due to the same cause. The œdema of the glottis was of that kind called *secondary*; it arose from the irritation induced by the disease of the cricoid, and the sub-mucous abscess that surrounded the loosened and carious cartilage.

CASE III.

December 3, 1836. I was desired to see Francis Luckcock, aged 30, brass-founder, a stout muscular man. He had been suffering for about a week from slight soreness in the throat and difficulty of swallowing; but the symptoms were not sufficiently urgent to induce him to apply for medical relief, or to desist from working. When I visited him he had soreness in the laryngeal region, increased by friction of the larynx against the spine and by pressure, pain in the same situation on attempting to swallow, inspiration attended with some difficulty and occasionally with a slight croupal sound. Voice natural, no fever, tonsils and fauces free from inflammation. Ordered twelve leeches to the sides of the larynx, and two grains of calomel and half a grain of opium every third hour.

5th., 11 A. M. The pain and difficulty of swallowing were quite removed by the leeches, the laryngeal soreness very much relieved, but the obstruction to respiration has increased: during the last night the dyspnœa has been so great as to prevent the patient from lying down. He now draws his breath with considerable difficulty, and the inspirations are more sonorous than before; he has a very hoarse cough, and occasionally expectorates a little white viscid mucus; he has the sensation of some foreign body in the throat, and is frequently endeavouring to get rid of it by swallowing. Countenance rather flushed and anxious; no thirst; pulse upwards of 80. I endeavoured to examine the state of the glottis, by means of my finger, but in vain; I could only reach the epiglottis, which appeared to be perfectly natural as to size and texture. Ordered twenty leeches to the sides of the larynx, four grains of calomel every third hour, and a large blister to be made with acetum lyttæ over the upper part of the chest.

At eight o'clock in the evening the condition of the patient was not in the least improved; the respiration was more stertorous and very laborious, countenance pale and extremely anxious, pulse quick. The blister had risen, and the breath had the mercurial fœtor. Under these circumstances, and with the prospect of the breathing becoming worse during the night, I proposed the immediate performance of tracheotomy, to which the patient willingly

consented. With the assistance of my colleague, Mr. Parsons, and Mr. Pedley, I did the operation in the following manner:—An incision was made through the integuments and the fascia of the neck, commencing just above the upper edge of the cricoid cartilage, and proceeding downwards about an inch and a half; the cricoid cartilage and the three superior rings of the trachea were thus exposed. After waiting three or four minutes for the subsidence of the hemorrhage, which was venous and of trifling amount, the three upper rings of the trachea, the cricoid cartilage, and the intervening membrane were divided from below upwards by a sharp pointed bistoury. The patient at first breathed freely through the artificial aperture, but in a very short time the respiration became exceedingly difficult, the countenance livid and covered with a cold sweat, and the pulse small and faltering. Violent attacks of coughing succeeded, and a considerable quantity of semi-coagulated blood was expelled both by the mouth and by the wound. This was repeated many times, and the efforts to cough were rendered more easy by holding the wound open with a director till the chest was filled with air, and then letting it close again when the expulsive action commenced. The head was kept inclined forwards, and the wound was sponged with cold water. The bleeding into the trachea at length ceased, a piece of gum-elastic catheter of the largest calibre was introduced through the external wound into the windpipe, and the patient was left in a comparative state of comfort, breathing easily through the artificial aperture. I was called up twice during the night to replace the tube, which was forcibly expelled from the trachea by severe fits of coughing.

On the morning of the 6th, I found that the piece of catheter, though fastened in its situation by a strong silk ligature passed round the neck, had been again forced out, and that the patient thought himself easier and more exempt from cough without it. Respiration was carried on partly by the wound and partly by the natural passages; but when the artificial opening was intentionally closed, the act of respiration was performed with great difficulty and attended by a loud stertorous noise. The voice was feeble and very hoarse; deglutition unimpeded. A quantity of thick mucus, mixed with pus and slight streaks of blood, had been expelled from the wound. He was ordered to continue the calomel and opium in small doses, as the obstruction to natural respiration was evidently rather on the increase than otherwise.

7th. Respiration the same as yesterday, cough more frequent and accompanied by a profuse muco-purulent expectoration, which escapes equally by the wound and by the mouth. Pulse quick, thirst, and great heat of skin; no pain along the trachea or in the chest. Ordered to continue the mercury, and to take a quarter of a grain of tartarised antimony every third hour.

9th. The patient is considerably better, the cough and expectoration are very much diminished, and the fever abated. He still makes use of the artificial aperture in breathing, and in attempting

to talk the air rushes through it with great force, but when purposely closed, respiration is accomplished without difficulty; the voice remains very hoarse. Salivation is established. The wound in the trachea has, up to this time, continued open without the use of any kind of canula; care is taken to cleanse it frequently and to smear its surface with a mild ointment. The only inconvenience the man experiences from it is a little soreness and stiffness during the act of deglutition. Ordered to discontinue the mercury.

13th. Since the last entry Luckcock has been progressively improving, the cough and expectoration are diminished, the respiration natural, appetite and strength returning. The voice remains very hoarse, but the attempt to speak is not attended with pain. The wound in the front of the neck has been closed to-day by means of strips of plaster, a pad of lint, and a bandage, and no dyspnœa has resulted.

17th. Luckcock is now convalescent; the external wound is nearly closed, the breathing perfectly free from obstruction and from any unnatural sound, the voice has regained its usual clearness of tone, and the cough has almost ceased.

Remarks.—The successful result of this case may still leave it, in some measure, doubtful whether the disease under which the patient laboured was œdema of the glottis. It was unquestionably a sub-acute inflammation of the upper part of the larynx, and attended with so much tumefaction of the mucous membrane or sub-mucous tissue as greatly to impede the act of inspiration. The absence of fever and of burning pain in the larynx, and the natural condition of the epiglottis, prove that the disease was not the acute catarrhal form of laryngitis. The obstruction to respiration, the sense of fulness in the throat, and the frequent attempts on the part of the patient to get rid of the cause of the fulness by swallowing, show the disease to have been an œdematous swelling of the sub-mucous tissue of the glottis. I shall return hereafter to the consideration of the operation of tracheotomy in cases of this disease; in the above instance it was completely successful, and I am inclined to attribute its success to the early period at which it was performed. The operation itself did not cure the disease, for it is recorded that, on the day after that on which the trachea was opened, the obstruction to respiration and the stertorous noise which accompanied it were rather increased. The cure must be ascribed to the action of mercury.

Diagnosis.—The remarks that have been made upon the diagnosis of acute laryngitis will apply with nearly equal force to the disease at present under consideration; for the symptoms and the pathological effects of both affections bear a strong resemblance to each other, and the differences between them are of degree more than of kind. We have in œdema of the glottis the least complicated form of organic laryngeal obstruction; there is at first no disturbance of any function but that of respiration, scarcely any pain is felt, no vascular excitement prevails, the intellectual and the

digestive functions remain unimpaired, and the patient is, in point of fact, undergoing a slow process of strangulation from natural causes. The distinctive signs of the disease are, the impeded powers of drawing air into the chest, coupled with the almost total absence of pain, heat or soreness in the region of the larynx, and the peculiar sensation of fulness about the upper part of the throat, conveying to the patient the idea of there being a foreign body in that situation, the removal of which is attempted by repeated efforts at deglutition. A new method of determining the existence of œdema of the glottis has been proposed by M. Thuillier;¹ it consists in exploring the upper part of the larynx with the finger. In order to accomplish this it is necessary to prop open the mouth by means of a piece of wood introduced between the upper and lower molar teeth, and to have the root of the tongue drawn forwards by a spatula or spoon; the extremity of the index finger will then reach the lips of the glottis, and an œdematous condition of these parts, if it exists, may be readily distinguished. I have already stated, in the report of Luckcock's case (page 44), that I attempted to explore the lips of the glottis in this manner, but that I could reach only to the epiglottis, which was thus ascertained to be free from disease. This of itself, however, was an important fact, for in acute laryngitis the epiglottis is always erect, tumefied, and curved forwards, whilst in œdema of the glottis this organ is either unaffected or but slightly swelled at its base. But the impossibility of reaching the superior margin of the larynx, which was experienced in the case of Luckcock, will, it appears to me, always be felt when adult males are the subjects of such an examination. In females, owing to the space between the mouth and the larynx being shorter, we should, in all probability, easily attain our object, and we have the evidence of M. Cruveilhier, in addition to that of M. Thuillier, that in them this plan admits of being accomplished.² If the lips of the glottis are œdematous they will present to the finger two tense, smooth and rounded tumours, just behind the epiglottis. In acute laryngitis similar tumours will be found in the same situation, but harder, and more painful on pressure being made upon them than in œdema of the glottis; the state of the epiglottis before alluded to will afford another differential sign between the two diseases.

Causes.—There are two varieties of œdema of the glottis, the primitive or idiopathic, and the secondary. It is called *primitive* when the disease is unconnected with any other local affection, and the causes of this variety are not at all understood. Bayle³ observes that it occurs frequently during convalescence from fevers of a typhoid character, but that he is quite ignorant what its occasional causes can be; and that, in almost all the patients in whom he witnessed the disease, he saw no reason to expect its attack before

¹ Thèses de la Faculté de Paris, 1815.

² Diction. de Méd., &c., art. Laryngite.

³ Diction. des Sciences Médicales, art. Œdème de la Glotte.

the moment when it manifested itself. The *secondary*, or consecutive form of the disease, is that in which the œdema is occasioned by some other disease of the larynx or the adjoining parts. Ulceration of the mucous membrane, necrosis of the cartilages of the larynx, and purulent collections in its immediate vicinity, are among the most common exciting causes of this consecutive œdema of the glottis.

Pathology.—œdema of the glottis consists essentially in an inflammation of the cellular tissue which connects the mucous membrane of the upper part of the larynx with the subjacent cartilages and muscles. The laxity of the sub-mucous tissue in this situation is exceedingly great, and, like the cellular structure in any other part of the body, it soon becomes infiltrated with serum when its vessels take on an inflammatory action. A familiar example of the effects of inflammation upon an organ chiefly composed of loose cellular tissue, is afforded by what occurs to the eyelid when attacked by erysipelas; a sub-cutaneous œdema, sufficient completely to close the eye, is often produced in a very few hours. The illustration may be carried farther: if the inflammation in the eyelid continues unchecked for a few days, the serous fluid first effused is replaced by one of a purulent nature: so it is also with the disease under consideration, for if the inflammatory process persists, and yet the tumefaction of the glottis is not sufficient to occasion death before the lapse of five or six days, we find small deposits of pus within the meshes of the sub-mucous cellular tissue, instead of the more ordinary serous effusion.

The pathological changes observed when death has been caused by this disease, are the appearance of two smooth, rounded, semi-transparent swellings, occupying the sides of the cavity of the glottis, and obstructing its area more or less completely, according to their development. These swellings are generally of a pale yellow colour, and devoid of apparent vascularity; they are formed by the effusion of serum into the sub-mucous tissue of the lips of the glottis, and of the folds of mucous membrane which connect the arytenoid cartilages with the epiglottis, and into the adherent surface of the mucous membrane itself in the same situation. The œdema is seldom confined to these localities, but extends to the base and lateral edges of the epiglottis, and to the mucous membrane lining the cricoid cartilage. The posterior and external surface of the larynx, the base of the tongue, and the tonsils, frequently participate in the disease. Both lips of the glottis may be equally affected by the œdema, it may interest one more than the other, or, as has occasionally happened, one of these bodies only may become the subject of œdematous infiltration. The difficulty of performing inspiration during the existence of this disease, is perfectly accounted for by the mechanical arrangement of the tumefied edges of the glottis; for on every attempt to expand the chest, the air, rushing from the pharynx in the direction of the rima, presses them towards each other, and causes them to close more or less completely the superior aperture

of the larynx; whilst, during expiration, the air passing from the trachea separates the sides of the glottis, and thus escapes with the greatest facility.

The fluid that produces the tumefaction in the sides of the glottis is limpid serum in those cases of the disease which have terminated rapidly; and where the affection has produced its effects more tardily, the effused fluid is of a sero-purulent nature. In both instances the deposition takes place into the meshes of the cellular structure of the adherent surface of the mucous membrane and of the sub-mucous tissue; and when, after death, incisions are made into the œdematous swellings, the fluid exudes slowly and gradually, and continues to flow out till the parts collapse nearly to their natural size.

The morbid alterations in the larynx, that act as exciting causes of the consecutive form of œdema of the glottis, will be described under the head of *Chronic Laryngitis*, to which they all belong. It should, however, be remarked in this place, that incurable chronic disease of the cartilages of the larynx, true *phthisis laryngea*, will occasionally result from a slowly developed œdema of the glottis; for if the patient lives through the first five or six days of the disease, small abscesses are formed in the inflamed sub-mucous tissue, the ary-tænoid and parts of the thyroid cartilages are separated from their cellular connections, become deprived of their perichondrium, and undergo necrosis: the mucous membrane sloughs or ulcerates, the danger of immediate suffocation passes away, and the patient is left to the more slow but certain ravages of laryngeal consumption.

At one period or other of its course, this disease is almost always mortal. Bayle had the opportunity of observing seventeen cases previously to the publication of his first essay on the subject, and of the whole number, only one recovered. "Since that time," he remarks, "I have seen it much less frequently: but the prognosis has not appeared to me at all more favourable."¹

Treatment.—Œdema of the glottis must be considered in almost every case as purely a local disease; the inflammatory action which produces the œdematous swelling is sub-acute, unattended by constitutional disturbance, and in numerous instances excites so little the attention of the patient, that a violent attack of suffocation first warns him of his danger. The stage at which the disease has arrived when we are first called upon to attempt its relief will demand suitable modifications in the plan of treatment. During the incipient periods we should put in requisition the usual measures for subduing inflammation, in the hope of preventing serous effusion from proceeding so far as to obstruct the passage of the air through the glottis; but when the symptoms already evince the existence of a serious impediment to respiration, and when accesses of suffocation have occurred, tracheotomy is the only measure on which the slightest reliance can be placed.

¹ Dict. des Sciences Médicales, art. Œdème de la Glotte.

The varying circumstances under which œdema of the glottis originates will also influence the mode of treatment to be adopted in any individual case. For example, if the disease is secondary to ulceration of the larynx or to any other of the forms of laryngeal phthisis, due consideration must be given to the primary disease, at the same time that we endeavour to avert the pressing danger incurred from the œdematous condition of the lips of the glottis.

General bleeding will rarely be required in this disease; a plethoric habit and a congested state of the lungs or brain may demand its performance, but œdema of the glottis will seldom be found in conjunction with such a condition of the circulation. Medicines of a depressing nature, such as tartar-emetic, are of little service, because no general arterial excitement prevails. Our chief reliance must be placed on the local detraction of blood by means of a large number of leeches applied in the vicinity of the larynx; on the use of blisters, which should never be put on the front of the neck, as their operation will interfere with the subsequent performance of tracheotomy, should such a step be necessary, but on the back of the neck or the upper part of the chest; and on the internal administration of large doses of calomel, which, either by their purgative effect or by their specific action on the general system, tend to check the inflammation in the glottis and to promote the absorption of the effused fluids. These remedies can only be of use during the early stages of the disease, and experience shows but too plainly that even then we have far more reason to anticipate failure than success.

If, in spite of the vigorous adoption of these remedial measures, the symptoms of impeded respiration persist, and attacks of impending suffocation come on, we cannot hesitate for an instant to perform tracheotomy. The remarks that were made in the preceding chapter on the folly of delaying this operation, and on its inutility when put off to the last moment, apply with equal force to the disease now under consideration. It is, in fact, worse than useless to have recourse to tracheotomy when the functions of the lungs and brain are almost annihilated, for the operation itself is compromised by the failure of success which must inevitably attend its tardy performance, and we are led to disbelieve its efficacy in other cases, whereas its inutility must be ascribed solely to our own miserable delay.

The case of Luckcock forcibly illustrates the good effects that may be expected from an early performance of bronchotomy, when the œdema is idiopathic. The leeches applied on the sides of the larynx relieved the soreness in this organ and removed the pain that was felt in the act of deglutition—they may be said, in fact, to have put a stop to the inflammatory action; but the tumefaction of the lips of the glottis remained, and would, in all probability, have speedily destroyed life, if an artificial passage for the air had not been created. In this case, after the respiration had been rendered free by the formation of an aperture in the trachea, mercury was

given till its constitutional effects were fully developed, and by this means was the œdematous state of the glottis removed. Mercury is a remedy of great promise in the idiopathic form of this disease: its *modus operandi* has been before described.

When œdema of the glottis comes on in the course of confirmed laryngeal phthisis the case is almost hopeless, since the morbid condition of the mucous membrane or of the cartilages of the larynx, which has been the exciting cause of the œdema, still persists. Mercury, in such cases, will but aggravate the original disease. Small topical bleedings and counter-irritation may be tried, and the disposition to spasmodic action in the muscles of the glottis should be checked by opium and other antispasmodic medicines. There is no reason, however, why we should not perform tracheotomy, in order to relieve the urgent symptoms of obstructed respiration, and thus prolong life for a short time. Moreover, by means of this operation, we afford the patient one additional chance of escaping ultimately from the grasp of the disease which is gradually destroying him; for, by making an artificial passage into the trachea, we give rest to the larynx, and prevent the irritation that must ensue from the constant transit of the air backwards and forwards, and thus place the vocal organ under the most favourable circumstances for recovering from its disorganised condition.

There are two or three other measures which have been recommended for adoption in the treatment of this disease, and to which it is only necessary just to allude. It has been proposed by MM. Bayle and Thuillier to introduce a tube into the larynx from the mouth, as a means of relieving the dyspnœa and preventing suffocation: but, considering the difficulty of accomplishing this when the entrance to the larynx is almost blocked up by the tumid state of the sides of the glottis, and considering also the inflammatory nature of the disease, and the aggravation of its symptoms that must ensue from the constant pressure of a foreign body against the inflamed structures, we cannot but reprobate such a proposition. M. Thuillier has suggested the plan of making pressure from time to time, by means of the finger, upon the distended lips of the glottis, in order to promote the absorption of the effused serum; and M. Lisfranc has proposed the making of small punctures in the œdematous swellings, to allow the escape of the fluid; but both plans are fantastic, very difficult, if not impossible of accomplishment, and more likely to increase than diminish the existing mischief.

CHAPTER VII.

ERYSIPELATOUS LARYNGITIS.

The occasional extension of erysipelas from the face to the fauces, and thence to the larynx, gives rise to a variety of laryngitis which produces similar effects to those of the idiopathic form of this disease, and causes death by suffocation in an equally rapid manner. Erysipelas has, therefore, been enumerated as one of the causes of laryngitis by authors who have written on the latter disease;¹ but some of the cases that follow indicate the existence of a peculiar inflammation of the fauces and larynx, which, in its progress and results, resembles that form of inflammation that is supposed to depend on the extension of erysipelas from the external surface of the body, and to which, therefore, the name of erysipelatoous laryngitis has been given. As illustrative of the subject, I shall present, in the first place, cases of this disease where the morbid action was propagated from the face to the fauces and larynx; and, in the second place, other cases in which the inflammation of the internal organs was unaccompanied by external erysipelas, though the latter disease was at the time extremely prevalent in the institution where they occurred.

CASE I.

Thomas Simpson, aged 35, a groom by occupation, was admitted into the Birmingham General Hospital under the care of Dr. Booth, on the 10th of November, 1834, affected with hemiplegia, for the relief of which a seton was introduced in the back of the neck. On the 22d, erysipelatoous inflammation commenced around the seton; by the 24th, it had extended to the cheeks. 27th. There was sore throat and great difficulty of swallowing. 28th. It is with extreme difficulty that the patient can swallow even a table-spoonful of broth; he lies in a state of stupor, with occasional delirium. 29th. Deglutition worse, coma, respiration quick and sonorous, pulse 140. He died during the night.

Dissection, eighteen hours after death.—The mucous membrane of the fauces was highly inflamed, and covered with flakes of recent lymph. The epiglottis was inflamed and tumefied, and its sub-mucous tissue was infiltrated with pus. Beneath the investing membrane of the lips of the glottis and the upper parts of the larynx, the sub-mucous cellular structure was in a sloughy condition and loaded with purulent matter.

The details of the progress of disease in this case are rather meagre, but they show, in a manner sufficiently distinct, the

¹ Dr. Cheyne, Dict. of Pract. Med.; Mr. Wood, Medico Chir. Trans., vol. xvii., p. 164.

extension of the inflammation from the cheeks to the fauces and pharynx, producing sore throat and impeded deglutition, and its farther extension to the larynx, when the breathing became quick and sonorous.

CASE II.

George Barnacle, aged 52, shoemaker, a man of feeble constitution originally, and who had been confined to the house for three or four years by extensive secondary syphilitic ulcerations on the legs, was attacked during the evening of the 10th of August, 1836, with erysipelas of the face. I first saw him on the 13th: the redness and tumefaction attendant upon the disease then existed all over the face and forehead; the eyes were closed by the infiltration of the eyelids; the usual febrile symptoms were present, together with intense headache and some confusion of thought. Leeches were ordered to the temples, the face to be incessantly fomented, and a diaphoretic mixture, containing antim. tartar. and liq. ammon. acet., to be taken frequently.

14th. The leeches had bled profusely, the head was much easier, and the inflammation and swelling of the face somewhat diminished. The patient complained of dryness and heat about the mouth and fauces, with difficulty of swallowing; no pain on pressure in the laryngeal region; the lips and tongue were so much swelled that it was impossible to inspect the back of the mouth. Pulse frequent, but weak and compressible; continual diarrhœa; the patient so feeble as to be incapable of getting out of bed. The general debility was so great that I dared not have recourse to any depletory measures, though I felt assured that the erysipelas was extending towards the larynx: a large blister was applied to the upper part of the sternum, and some laudanum was added to the antimonial mixture.

15th. The patient continues much the same as yesterday.

16th. He has been violently delirious during the past night, and now lies in a somnolent condition, occasionally muttering incoherently, but is capable of being roused. The external erysipelas has extended along the front and sides of the neck; difficulty and pain in swallowing increased; voice weak and hoarse; occasional short cough, producing pain in the laryngeal region; respiration not accelerated, but accompanied by a slight wheezing.

At mid-day of the 17th, the patient was evidently sinking fast; it was with extreme difficulty that he could be roused; the respiration was croupal, the voice reduced to a scarcely audible whisper; he could only swallow a tea-spoonful of any thing at a time, and a short hacking cough followed every attempt of the kind. He became comatose soon after I saw him, and died at midnight.

Dissection, fifteen hours after death.—There was no appearance of death by suffocation; the veins of the neck were not distended; on opening the chest the lungs collapsed, and they were not con-

gested. The mucous membrane of the pharynx was inflamed, and its muciparous follicles greatly developed, especially in the vicinity of the larynx; there were two patches of coagulable lymph, beneath which the mucous membrane was highly injected and of a dark-red colour. The œsophagus was pale and healthy. The epiglottis was very much thickened, its edges were curved backwards towards the cavity of the larynx; the membrane investing its anterior face was very tumid, of a bright-red colour, and the sub-mucous tissue was infiltrated with serum. The membrane lining the posterior or laryngeal face of the epiglottis, and the whole of the mucous membrane of the larynx above the superior ligaments of the glottis, were covered with a thin layer of lymph, which, on being scraped off, showed the surface beneath of a uniform dark-red or nearly purple colour. The arytænoideo-epiglottic ligaments were thickened. The remainder of the mucous membrane of the larynx and that of the trachea were injected and covered with mucus, but the acute inflammation had not extended below the superior vocal ligaments.

Remarks.—In this case there can be little doubt that the immediate cause of death was the impaired condition of the brain, probably from serous effusion into its cavities, but, owing to some unfortunate neglect at the time, this could not be ascertained: the head was not opened. The cadaveric appearances account satisfactorily for the symptoms witnessed during the two last days of life: the contraction of the superior aperture of the larynx, from the universal thickening of the parts that form its margins, though not sufficient to impede respiration in a degree fatal to life, caused the cough and the croupal sound by which the breathing was accompanied; whilst the inflamed state of the pharynx, together with that of the larynx, account for the painful and difficult deglutition. The effusion of lymph upon the mucous membrane of the glottis and epiglottis adds another to the numerous proofs that inflammation with membranous exudation is not a sign of vigour, but, on the contrary, is more frequently found to occur in debilitated and broken down constitutions.

CASE III.¹

A woman, aged 34, was admitted into the Hôpital Cochin, for disease of the heart. On the 23d of February, 1822, after eating more than usual, she was seized with rigors, followed by vomiting, and on the following day erysipelas appeared upon the face. On the 25th and 26th, the erysipelas extended towards the neck and the hairy scalp, and the eyes were completely closed by the œdema of the eyelids. 27th. Violent pain in the throat, difficulty of swallowing, respiration impeded and quicker than natural. 28th. Respiration, speech, and deglutition more and more difficult. March 1st. The tumefaction of the neck is enormous, suffocation imminent, and

¹ Bouillaud. Archives Générales de Médecine, tome vii., 5 p. 178.

the voice nearly extinct. She died during the day, in a state of asphyxia.

Dissection, twenty-four hours after death.—The mucous membrane of the bronchi, the larynx, and the pharynx, was red and inflamed; the epiglottis and its ligaments were considerably thickened; the glottis was nearly closed by the swelling of the surrounding parts. The cellular tissue of the larynx and that of the neck and face were reddened, œdematous, and infiltrated with pus. The lungs were healthy.

Other examples of this affection, similar both as to their progress and result to those just detailed, might be given in proof of the occasional extension of erysipelas to the larynx; but they are quite unnecessary, and I shall therefore give, in the next place, two instances of idiopathic laryngitis, which occurred in an hospital where erysipelas was, at the time of their occurrence, exceedingly prevalent, and which, in their anatomical characters, bear so close a resemblance to the cases that have just been cited, that I have not hesitated to call them *erysipelatoous laryngitis*.

CASE IV.

Thomas Bant, a stout man, aged 67, had his leg broken by the kick of a cow, on the 22d of December, 1834; he was immediately admitted into the Birmingham Hospital, under the care of Mr. Hodgson, and in five weeks the bones were nearly united. From the 2d of February to the 6th, he felt generally indisposed, fancying he had caught a slight cold from having worn damp clothes, but he made no particular complaint to his medical attendant. On the 6th he had shiverings, and complained of lowness of spirits, weariness, pains in the loins, headache, and of slight soreness of the throat without any difficulty of swallowing. 7th. The throat is more painful, and the fauces are found on examination to be a little inflamed. 9th. He complains more of his throat; the tonsils are tumid and red, presenting the appearance of cynanche tonsillaris. 10th. Considerable enlargement of the right tonsil, without any appearance of ulceration; difficulty of deglutition, but none of articulation; no thirst, appetite moderate, urine plentiful; some anxiety and pallor of the countenance. 11th. Tonsils much less tumefied, deglutition easier; his spirits are better; eat meat for his dinner; no cough, pulse frequent and small. In the evening he drank some wine and water without much effort, and his voice was quite natural. In the middle of the night he awoke suddenly, and could scarcely get his breath; exclaimed with difficulty that he was choked, and died in less than ten minutes.

Dissection, thirty-four hours after death.—The throat was first examined. There was extensive deposition of pus in the cellular structure beneath the mucous membrane of the epiglottis, on its anterior surface and upper border. The pus was infiltrated through the sub-mucous tissue, and not formed into abscess. When cut

into, this part resembled accurately the sloughy and puriform condition of the cellular tissue of the extremities, in cases of phlegmonous erysipelas. The pus extended outside the larynx between this organ and the pharynx, and the mucous membrane covering the right arytaenoid cartilage was in a state of slough; the ventricles of the larynx and the rima glottidis were scarcely perceptible, owing to the very œdematous state of the sub-mucous cellular structure. The laryngeal mucous membrane was of a red mottled appearance, and covered with a thick coat of tenacious mucus. The trachea and bronchi were of a vivid red; they contained very little secretion. The lungs were much congested with dark blood, which flowed out in great quantities when they were cut into. The other viscera were healthy.

My friend, Mr. W. Bowman, house pupil at the Birmingham Hospital, remarks, at the conclusion of the narration, "there was no case of erysipelas in the ward where this man lay at the time of his attack, but the disease was very prevalent in the hospital. For a year before it broke out, there were no cases of this affection of the larynx, and there have been none since the hospital has been free from that scourge, which is now more than six months."

CASE V.

October 30, 1834. Susan Thomas, aged 46, was admitted on account of a fractured arm, into the General Hospital, Birmingham, under the care of Mr. Hodgson. At this time erysipelas was exceedingly prevalent in the wards of this institution. The fracture did well, but at the end of the fifth week she was seized with sore throat, accompanied by typhoid symptoms; she had great difficulty of breathing, and died on the third day from suffocation.

Dissection.—The fauces were inflamed; the epiglottis was swollen and inflamed, with extensive deposition of pus beneath its mucous membrane, and in the adjacent cellular structure at the root of the tongue; between the larynx and pharynx the cellular tissue was in a sloughy state, whilst the contiguous mucous surfaces presented patches of a vivid red. The inflammatory appearances did not extend down the trachea or œsophagus.

The evidence afforded by the cases which have just been related is, I conceive, conclusive as to the existence of an erysipelatous form of laryngitis from an extension of the morbid action present in the face along the continuous mucous surfaces of the mouth, fauces, and pharynx, to the larynx; and also of another form or modification of the same affection, in which, the fauces being attacked by erysipelatous inflammation, the disease may spread to the larynx, producing disorganisation and death, without the presence of any external erysipelas. It must have occurred to almost every surgeon to have witnessed erysipelas spread from the face to

the fauces, producing pain and redness in that situation, with difficulty of swallowing; though an extension of the morbid action to the larynx, I am inclined to think, is rather uncommon. The silence of most writers on erysipelas as to this point must be admitted as evidence of the rarity of the complication in question, for its fatal nature, when it does happen, would ensure it from passing quite unnoticed. Dr. Gibson, in the third volume of the *Transactions of the Edinburgh Medico-Chirurgical Society*, describing the epidemic erysipelas at Montrose in 1828, says, "Sometimes the internal fauces were attacked; and if it spread to the trachea it generally proved fatal." In the following case that fell under my own observation, I have reason to believe the larynx was implicated, though the recovery of the patient still leaves it, in some measure, doubtful.

CASE VI.

John Coleman, aged 9, went to the hospital on the 6th of September, 1835, to visit his sister, who was confined to bed with severe erysipelas of the face and head, which had commenced in the neighbourhood of a seton inserted for the relief of some ophthalmic affection. At the time he went there he had a sore upon the ala of the nose. On the 9th (three days after) the disease appeared round this sore, and on the 10th, when I was called to visit him, it had extended to the cheeks and eyelids; the erysipelas spread all over the face and scalp, and on the 15th the patient complained of pain and heat in the throat, and difficulty of swallowing. The fauces, when examined, appeared of a dark-red colour and slightly tumefied. (The whole of the inflamed external surface was covered thickly with mercurial ointment, and strong calomel purgatives were administered.) In three days from this time the breathing became hurried and difficult; there was cough and inability to lie down; leeches were applied to the throat, and the external mercurial application was continued. The dyspnoea yielded to the remedies employed, the inflammation of the throat and difficult deglutition soon disappeared, and on the 30th (three weeks from the commencement of the complaint) the patient was convalescent.

Dr. Stevenson, in a letter to Dr. Thompson,¹ speaks of a severe affection of the throat, which occurred so frequently in persons who had been much with erysipelatous patients, that he came to the conclusion that "it was in reality erysipelas of the fauces, spreading occasionally to the adjacent parts in different directions." In some of the cases the disease never appeared externally; in most of them external erysipelas supervened to the sore throat, but no instance of the reverse occurred. In a few cases the disease spread to the larynx, producing a state of respiration very like that of idiopathic croup. This appears to have happened in four of the twenty-one

¹ Trans. of the Med. Chir. Soc. of Edin., vol. ii., p. 128.

cases of erysipelas, an abstract of which is presented at the close of the letter, and of the four one only died. No account is given of the post mortem appearances. Copious and repeated bleeding, and the application of a large number of leeches to the neck, was the mode of treatment made use of, and the facts just stated answer well for its efficacy.

The following case appears to have been of the same nature as those that Dr. Stevenson met with:—

CASE VII.

Hannah Newell, aged 17, cyprian, was admitted into the Town Infirmary, August 27th, 1836; at which time erysipelas of the face was rather prevalent in Birmingham. She was suffering apparently from the effects of a severe attack of cynanche tonsillaris, though the impossibility of opening the mouth rendered fruitless all attempts at examining the throat. The symptoms were general fever, quickened respiration, painful and difficult deglutition, and soreness behind the angles of the jaw. Leeches were applied in the situation last indicated, antimonial medicines were administered, and the patient was directed to inhale the steam of hot water frequently. On the following day, as the relief, though considerable, was not complete, a blister was applied across the lower part of the throat. On the 29th the symptoms were greatly relieved; the patient could swallow liquids without pain or difficulty, and the fever had abated; but erysipelatous inflammation had commenced around the lips, and in two days spread all over the cheeks and forehead. The external erysipelas was combated by the usual means, and in the course of a few days the patient was convalescent, the throat having entirely ceased to suffer after the appearance of the cutaneous inflammation.

This case, and those of Dr. Stevenson, which have just been referred to, enable us more completely to justify the application of the term *erysipelatous* to the variety of laryngitis which it is the object of this chapter to describe. In the instance of Hannah Newell, erysipelas commenced in the fauces, and thence spread to the face: whilst in Dr. Stevenson's cases, the external form of the disease generally appeared after the sore throat, and in a few cases the erysipelas extended in the other direction, reached the larynx, and produced a state of respiration like that of idiopathic croup. It will be observed, that, in every instance, the fauces were attacked previously to the larynx being implicated, whether, as in Cases I., II., III., and VI., the erysipelas first appeared externally, and then marched inwards, or in cases IV. and V., where there was no cutaneous erysipelas, but in which the affection of the larynx was preceded by symptoms of inflammatory action in the fauces.

Pathology.—It would be presumptuous to attempt accurately to

define the pathology of the disease in question from the results of five fatal cases only; we can, however, remark the points in which they resemble each other, and in which they assimilate to cases of idiopathic laryngitis, and also the special differences that exist between them. 1st. In Cases I., II., IV. and V., the morbid changes are more conspicuous on the epiglottis and the upper and external parts of the larynx than within the cavity of this organ, in which respect the erysipelatos resembles the ordinary form of laryngitis; and the circumstance is, with respect to the former disease, to be accounted for by the mode in which the morbid action spreads along the continuous surfaces of the fauces and pharynx, and of course first attains the epiglottis and superior portion of the larynx. 2d. The structures invaded are the mucous membrane and sub-mucous tissue, but the disorganisation in the latter is more remarkable than in the former, and, except in Case II., the appearances denoting the previous existence of inflammation consist of that patchy redness which distinguishes the sub-acute from the acute form of inflammation. 3d. The products of the inflammatory action are serous infiltration of the sub-mucous tissue of some parts of the larynx in Cases II., III., and IV.; the deposition of pus within the meshes of the sub-mucous tissue of the epiglottis and the upper margins of the larynx, and a sloughy condition of some part of the sub-mucous cellular structure, in Cases I., IV., and V.; this lesion having a strong analogy with the effects of phlegmonous erysipelas when it occurs in the extremities; and the exudation of lymph on the mucous membrane of the pharynx in Cases I. and II., and on the investing membrane of the epiglottis and glottis in Case II. The trachea, in almost all the cases, was found more or less reddened, whilst the œsophagus was, in every instance, quite free from the traces of inflammatory action.

Nature of the disease, and treatment.—The inflammation of the larynx that ensues from the extension of erysipelatos disease already present in the face or fauces, will, it may safely be assumed, partake of the character of its original source; and on reconsidering the cases and the morbid lesions discovered in the post mortem inspections, we shall perceive that, during life, the vascular action was feeble and the nervous depression very great; in short, that the fever was typhoid; and, after death, the cadaveric appearances exhibited inflammation of a sub-acute kind in the mucous membrane, with a tendency to the formation of sloughs in the cellular tissue, and of undefined purulent depositions.

The time for active depletory treatment in erysipelas generally soon passes away, and in the variety of laryngitis now under consideration the primary disease will already have existed some days, and the attendant fever, if at first of an active and inflammatory type, will, in all probability, have assumed a low typhoid character. On these accounts, general bleeding and other vigorous antiphlogistic measures cannot safely be had recourse to. The first and most important indication in the treatment of this disease, considered as

a whole, and viewing the inflammation of the fauces as a necessary preliminary to the affection of the larynx, is to arrest the morbid action in the former situation, and thus to prevent its attaining the larynx, where its effects appear to be almost invariably mortal. If, therefore, an individual labouring under an attack of erysipelas of the face should be seized with pain, heat, and dryness in the mouth and throat, and impeded deglutition, we should be justified in believing that the erysipelatous inflammation had extended to the fauces, and every effort must be made immediately to subdue it, and to prevent its farther extension. The application of leeches behind the angles of the jaw, and of a blister to the upper part of the sternum or to the back of the neck, should be had recourse to without any delay; the inhalation of the steam of hot water forms a valuable local application, and will often cause the vessels of the dry and inflamed mucous membrane to relieve themselves by secretion. The adoption of internal remedies must be regulated by the state of the pulse and the general condition of the patient. If the erysipelatous disease is recent, if the pulse is full and quick, the skin hot, and the strength of the patient not much reduced, tartarised antimony may be given in such doses as will diminish the force of the circulation and subdue the pulse, and mercurial purgatives may be exhibited for the attainment of the same objects.

But, as a general rule, it will be found, in cases of this kind, that medicines of a depressing nature cannot be borne, and that depletion will rather increase the tendency of the disease to spread to contiguous surfaces; wherefore, at the same time that we endeavour to relieve the local affection by drawing blood from the neighbouring parts and by the application of blisters, the beneficial effects of which cannot be too strongly insisted on, it will be necessary to support the strength of the patient by wine, quinine, and other tonic and stimulating remedies, and by a generous diet. If a sense of constriction about the laryngeal region and dyspnœa give indications that the inflammation has reached the larynx, the same plan of treatment must be pursued; the application of leeches to the sides of the throat must be made, if the patient's condition is such as to justify it, and, under any circumstances, counter-irritation in the neighbourhood of the larynx must be speedily and efficiently created either by means of the acetum lyttæ, the application of boiling water, or some other of the known methods of exciting rapid vesication. "Latour twice saw inflammation of the larynx in connection with erysipelas: he found blisters very beneficial in these cases."¹ They appear, in fact, to be the external remedies on which our chief reliance should be placed, as they evince a singular power of preventing the extension of erysipelas in other parts of the body. If, notwithstanding the vigorous application of these remedial measures, the obstruction to respiration increases, it will be proper to

have immediate recourse to tracheotomy, rather than suffer the patient to perish miserably by suffocation.

In the chapter on acute laryngitis, so much has been said on the necessity of an early performance of tracheotomy that it is useless to repeat the remarks in this place. We cannot certainly anticipate so much success from the operation in cases of erysipelatous laryngitis, because the erysipelas, having existed for some days previous to its attacking the larynx, will have considerably lowered the powers of the system, and perhaps have impaired the condition of the brain; and moreover it will be recollected that, in most of the fatal cases of this disease, not only was the disorganisation of the larynx carried to a great extent, but there were also conspicuous marks of the morbid action having been propagated along the trachea. Whether these results might be prevented by the early performance of the operation in question is at present doubtful; but, considering the inadequate relief afforded by other means, it would be right to give the patient the benefit of that doubt.

CHAPTER VIII.

CHRONIC LARYNGITIS.

Under this general name have been classed certain diseases of the larynx, distinct both as to the structures they invade and as to the kind of disorganisation they produce, but all of them of an inflammatory nature in the first instance. Their commencement is, for the most part, very insidious, and their progress is so slow and so completely divested of signs calculated to alarm the patient, that serious mischief will, in many cases, have resulted, before he is aware that his sufferings are occasioned by any thing more than a severe cold.

The parts of the larynx usually affected by chronic inflammation are the mucous membrane and its subjacent tissue and the cartilages; and, for the sake of convenience, chronic laryngitis will be divided into two general heads, viz. that affecting the mucous membrane and the sub-mucous tissue, and that implicating the cartilages. Both species have occasionally received the name of *phthisis laryngea*, though the latter has perhaps the best claim to the title, from the incurable nature of the affection, and from the hectic and emaciation which invariably accompany its latter stages.

1.—CHRONIC LARYNGITIS AFFECTING THE MUCOUS MEMBRANE
AND THE SUB-MUCOUS CELLULAR TISSUE.

Symptoms.—This species of chronic laryngitis is generally ushered in by hoarseness of the voice and a sense of dryness about the upper part of the throat, which may be imputed to a common cold; in a few days these symptoms are succeeded by a short, dry, hacking cough, which is attended with a feeling of uneasiness or positive pain in the situation of the larynx, and if pressure is made at the sides of the thyroid cartilage, or if the larynx is rubbed against the anterior surface of the spinal column, soreness to a greater or less degree will be experienced. If the disease is suffered to go on unchecked it may terminate in various ways. In some instances a sense of constriction is felt at the superior orifice of the larynx, the act of inspiration becomes more and more difficult, and is attended by a noise as if the air were drawn through a metallic tube; attacks of a spasmodic nature occasionally supervene, causing a great exacerbation of the symptoms and terrible difficulty of breathing during their continuance; the voice becomes stridulous at first and is ultimately quite extinguished, and symptoms of imminent suffocation, which of course produce intense alarm and anxiety, are the usual forerunners of an unfavourable termination. In this, and in almost every other form of chronic laryngitis, the dyspnœa and the cough are rendered much more distressing on the approach of evening. In other instances the conclusion of the disease is not marked by any approach to suffocation, but by a frequent irritating cough, together with hectic, emaciation, and gradual decay. When unaccompanied by tubercles in the lungs, this form of the complaint has generally received the name of laryngeal phthisis or consumption. In other instances, again, the disease lingers a long time, the constitution struggling effectually against the local malady, till recovery takes place; but, in all cases, persons once attacked by chronic laryngitis seem to be liable to relapses for a considerable time afterwards.

The hoarseness that accompanies an ordinary catarrhal attack, is unquestionably owing to a sub-acute inflammation of the larynx, which produces some tumefaction of the mucous membrane of this organ: when secretion from the surface of the membrane is established, the hoarseness disappears.

Cases of chronic laryngitis will exhibit its symptoms and terminations more forcibly and better than any lengthened description. In the 11th volume of the *Edinburgh Medical and Surgical Journal*, a case is recorded which well illustrates the termination by suffocation.

CASE I.

“E. W., aged 23, a female servant, began to be affected with a disorder producing coughing slightly at times, especially on bodily

exercise, with little dyspnœa, and pretty constant wheezing, in September last, from no known cause. Pains in the chest, spitting of mucous matter, soreness of the throat, and hoarseness, without any appearance of disease visible in the fauces, supervened in the course of a month. With some difficulty the patient continued to perform her duties till the latter part of December last; then she applied for relief, the above-related symptoms having become more and more vexatious." A small bleeding was practised, various medicines given, and repeated blisters applied round the throat.

"None of the symptoms increased, excepting that the voice became much more affected, often producing what was called by the patient and attendants 'a whistling,' and at length the breathing was so bad that some degree of orthopnœa manifested itself. There was little or no difficulty in deglutition, nor any constitutional symptoms. On the 7th of February, the patient visited some friends about half a mile distant, she returned on foot at ten o'clock in the evening, and the air was very cold. About one o'clock in the morning feelings of suffocation came on. * * * * *

The poor sufferer died about four o'clock, seeming suffocated."

Sectio cadaveris.—There was no disease in the chest or abdomen. "The trachea being cut out, the larynx was seen stopped up by thickening of the epiglottis, as well as of the membrane lining the larynx, and by a thick fluid consisting of mucus and coagulated lymph. There was general thickening of the thyroid, cricoid, and arytaenoid cartilages, a little pus was seen upon the arytaenoid cartilages, and a superficial ulceration."

The narrator of the case remarks, that "although the passage for the air had for many months been considerably contracted, yet merely on that account death would not have been occasioned. It was the increased secretion from the membrane lining the larynx, suddenly produced by the exertion of walking in the cold air and returning into a warm room, which blocked up the superior part of the windpipe, already very much straitened by organic disease."

Chronic laryngitis is so seldom fatal of itself—at least when recognised and properly treated—that, were it not for the intervention of other diseases with which it is associated, or which supervene upon it, we should rarely have the opportunity of witnessing the organic changes that it effects.

The symptoms in the case just related, that require particular consideration, are the state of the respiration and voice. At first there was "pretty constant wheezing," especially on bodily exercise; in the course of a month hoarseness came on; after the lapse of about three months the voice became much more affected, producing a whistling, and at length orthopnœa manifested itself. Soon after this it was that the patient died; the voice having never been altogether suppressed.

CASE II.¹

A woman, aged 40, applied to M. Cruveilhier on account of an extinction of the voice and hissing respiration. A mercurial plan of treatment was adopted, and the state of the patient became considerably ameliorated, and remained so for eight months. At the end of this time the voice again began to fail, and the respiration became sonorous. From the 20th of August to the 24th of October, 1821, this patient suffered continually from croupal cough and respiration, and occasionally from attacks of suffocation, during which the act of inspiration was exceedingly difficult and attended by so much noise, that the breathing could be heard in the room below that in which the patient slept. The countenance was pale, the extremities cold, and the pulse small and unequal. On the 24th of October she had an access of suffocation, not more severe than the preceding ones, but she died during the night.

Dissection.—The cavity of the cricoid cartilage was nearly filled up by an indurated tissue situated between the mucous membrane and cartilage. The induration had likewise affected the vocal cords and the ventricles of the larynx; the former could scarcely be recognised. A small aperture for the passage of the air existed in the centre of the thickened and indurated mucous membrane.

This and the preceding case are sufficient to illustrate the termination of chronic laryngitis by induration and thickening of the mucous membrane. A more common effect of this disease is ulceration of the lining membrane of the larynx. This effect, however, is more frequently observed in connection with pulmonary phthisis and with syphilis than as a regular termination of idiopathic chronic laryngitis. Under whatever circumstances ulcers occur within the larynx, the fact is indicated by a considerable alteration in the tone of the voice, and, if the ulcers are extensive, by its utter extinction; by a dry cough, which is oftentimes convulsive and painful, and in many cases by a less impeded state of the respiration, in consequence of the diminished tumefaction of the mucous membrane subsequent to the setting up of ulceration.

CASE III.

John Taylor, aged 34, shoemaker, a remarkably stout man, but subject to a cough, was seized with symptoms of continued fever, then prevalent, on the 4th of November, 1834. On the 8th he first complained of difficulty of breathing and cough; the expectoration was trifling in quantity, whitish, and very adhesive. 10th. Considerable tenderness was felt in the laryngeal region, with a sense of heat

¹ Dictionnaire de Médecine et de Chirurgie Pratiques, art. Laryngite.

in the throat and all over the thorax. Inspiration attended with difficulty, cough hoarse, voice rough and discordant. Leeches were applied to the front of the neck, followed by a blister over the upper part of the sternum, and a tartar emetic mixture internally. 12th. The symptoms of inflammation of the larynx were ameliorated by the treatment pursued; the cough was better, the expectoration more fluid and voided with facility. The voice, however, which before had only been rough and harsh, was now reduced to a whisper, and in this state it continued till the time of the patient's death, which happened during the night of the 17th, in consequence of hemorrhage from the bowels. Previous to the fatal occurrence the laryngeal and pectoral symptoms had disappeared, except the state of complete aphonia.

Dissection, twenty-nine hours after death.—The body was sanguineous, but not much emaciated. The lungs were healthy, with the exception of an emphysematous condition of the edges of the lower lobes; there were no tubercles in them, and very little mucus in the bronchi. The membrane lining the trachea and bronchi was rather vascular. The mucous membrane of the larynx was slightly injected, and on each of the vocal cords there was an ulcer; that on the left was superficial, that on the right had laid bare the ligament of the glottis for two-thirds of its length: a small clot of blood occupied the left ventricle of the larynx. An ulcer on each side of the superior part of the epiglottis had denuded the cartilage to a small extent, but there was no morbid thickening of this organ, nor any unusual vascularity, except just at the edges of the two ulcers.

The hemorrhage from the bowels, which caused the death of this individual, had taken place from three or four large sloughy ulcers in the last six inches of the intestinum ileon.

Remarks.—In this case there was no œdema nor any thickening of the lips of the glottis, and from the great improvement that took place in the state of the respiration and cough, it is highly probable that the patient would have recovered, had it not been for the intestinal ulceration and hemorrhage. With respect to the voice, we observe a remarkable difference between this and the first case; for though the laryngeal disease in Taylor was productive of symptoms infinitely less alarming than were those in the instance of the woman before narrated, yet the loss of voice in him was complete some days previous to death, and the state of aphonia continued till the occurrence of that event. We have every reason, therefore, to ascribe this particular effect to the ulceration of the vocal cords, which existed in his case, but not in that of the servant. In the second case, (that related by Cruveilhier,) the destruction of the voice is accounted for by the narrowing of the aperture of the larynx and the indurated state of the vocal cords. In the next case, there were no ulcers found within the larynx, but only such an inflamed condition of the mucous membrane as is, in all probability, the usual forerunner of them.

CASE IV.

Mary Sigley, aged 23, an unmarried female, pregnant seven months, was admitted into the Infirmary on the 15th of April, 1834. She had a dry cough, difficulty of breathing, both inspiration and expiration being accompanied by a harsh ringing sound; there was also soreness about the throat, pain in the chest, thirst, and accelerated circulation. Leeches were applied to the lower part of the neck, and calomel and tartarised antimony were given freely. The patient was a little relieved at first by these means, but the symptoms afterwards became more severe. In the beginning of May she was decidedly worse; the pain and soreness in the throat were very severe, the difficulty of breathing so great that the upright posture was absolutely and constantly necessary, respiration was accompanied by a noise as if the air were drawn through a metal tube, expectoration had become profuse, it was purulent and almost always tinged with blood. The only sound that could be discovered by the stethoscope, was a ringing respiratory sound. Various remedies were tried, and leeches applied to the throat three times, but with no good effect; the symptoms of approaching suffocation became at last so urgent that it was determined to give mercury to the extent of producing salivation. This plan was commenced on the 5th of May, and on the 7th the mouth became affected; the dyspnœa was soon relieved, and the voice, which before had been scarcely audible, was now distinct and loud enough. The same day she gave birth to a child, living, but very small and feeble, evidently premature. On the 8th she seemed doing well, except that her weakness and restlessness were great. She died at noon on the 9th, two days after delivery.

Dissection.—The left lung adhered completely, by a delicate but thoroughly organised cellular substance, to the costal pleura. The right lung was collapsed and externally natural. In the upper lobe of the left lung a large cavity was found, and multitudes of tubercles in all stages were diffused throughout each lung. In the right there were two or three suppurated tubercles towards the superior parts of the lung. The larynx, trachea, and bronchi were greatly inflamed, of a deep-red colour, and the mucous membrane was thickened. The larynx was free from ulcers, but at the upper part of the trachea the lining membrane was destroyed by an extensive ulceration, the exposed sub-mucous tissue having a granular appearance. In the left bronchus, between its subdivisions and the tracheal bifurcation, were numerous ulcers of various sizes.

Remarks.—In this case, although the autopsy showed phthisis to be so far advanced, it was not suspected before death, partly perhaps, because of the pregnant state of the patient, but chiefly because the stethoscopic signs of consumption were completely masked by the nature of the respiratory sound, which was so intense as to overwhelm all minute distinctions. This ringing sound, as if the air

were drawn through a thin metal tube, was probably owing, in this instance, to the trachea being extensively inflamed, and its mucous membrane, in consequence, so much swelled as considerably to narrow the area of the tube; but the dyspnœa, and the inability to breathe in any but the upright posture, were owing undoubtedly to the inflamed and thickened condition of the *laryngeal* mucous membrane, as the aperture of the glottis is so small, compared to the size of the trachea, that a degree of contraction which, in the latter would produce but little obstruction to respiration, in the former would induce an approach to suffocation. Nor from the post mortem examination, can we exactly calculate how far this thickened state of the mucous membrane had been carried during life; for the relief obtained on the occurrence of salivation two days previous to death was so manifest, that it is reasonable to conclude that a marked diminution of the disease, as well as of its symptoms, had been effected by the mercury. No ulcers were found in the larynx in this subject, although there were some in the trachea and in one of the bronchi; but had the life of the patient been prolonged, it is probable the laryngeal membrane would have ulcerated.

The two following cases are offered as examples of that form of chronic laryngitis, in which death ensues from the hectic and emaciation produced by long continued ulceration of the larynx, together with such disorganisation of the epiglottis as obstructs the due performance of the function of deglutition. As they appear to have been unconnected either with disease of the lungs or with syphilis, they may be viewed as genuine instances of laryngeal consumption.

CASE V.

Ann Baker, aged 28, married, applied at the Infirmary, February 16, 1836, for medical relief, on account of soreness of the throat generally, and particularly of the laryngeal region, cough, difficulty of swallowing, and general fever, from which she had been suffering more than a month. On inspecting the fauces, nothing unusual was observable; the soreness of the throat was increased by pressure over the thyroid cartilage and by friction of the larynx against the spine behind. I attended her for some time without affording her any material relief. On the 24th of March, I was again requested to visit her. She was then much worse, and had been confined to bed for several days; the cough was very frequent, and attended by mucous expectoration; deglutition was more painful, and the attempt to swallow liquids produced feelings of imminent suffocation and an instant rejection of the liquid through the nostrils; the pain in the laryngeal region was rather diminished, and the soreness on pressing the larynx against the spine very much lessened; the voice was reduced to a whisper; respiration was hurried and accompanied by a sibilous noise; there were also orthopnœa, hectic, and

emaciation. Her appetite remained good, but from the pain which always attended deglutition, and the absolute impossibility of swallowing liquids, she was compelled to abstain from food almost entirely. A blister was applied to the throat, and opiates were given with the hope of alleviating the cough, but death ensued on the evening of the 25th, in the midst of an unusually severe fit of dyspnœa.

Dissection.—Permission could only be obtained to examine the throat; but as there were no particular indications of thoracic disease, this restriction was a matter of little consequence. There were two or three broad superficial ulcers at the lower part of the pharynx and on the back of the tongue close to the root of the epiglottis. The mucous membrane of both the anterior and posterior surfaces of the epiglottis was covered with ulcers, intermixed with red projecting granulations or caruncles, and the upper edge of this organ was festooned, and, as it were, eaten away to the extent of about a third of an inch. The lips of the glottis were greatly thickened, so as internally to diminish the area of the larynx, and also to project externally much more than usual. The mucous membrane covering these thickened parts, and that lining the cavity of the glottis, the ventricles of the larynx, and that part of the organ immediately below the vocal cords were superficially ulcerated throughout.

Remarks.—Considering the severity of the morbid lesions in connection with the symptoms observed during the latter periods of life, we note, in the first place, the slight degree of pain that was experienced, except during the act of swallowing; 2dly, the continual cough, dyspnœa, and general difficulty of deglutition; and 3dly, the impossibility of swallowing liquids, which I entertain no doubt must be ascribed to the partial destruction of the epiglottis, and the inefficient protection it was able to afford to the cavity of the glottis, rendered excessively irritable by the ulcerated state of its investing membrane. There was no evidence in this patient either of a phthisical habit, or of any previous syphilitic disease.

CASE VI.¹

A man, aged 40, entered the Maison Royale de Santé with all the symptoms of laryngeal phthisis; emaciation without fever, voice extinct, frequent cough, and purulent expectoration. The examination of the fauces showed an erosion of the edges of the epiglottis and ulceration of its anterior face. This man had suffered from laryngeal cough and hoarseness for eight or nine months, but had continued to work till about a fortnight before his admission. Deglutition was very difficult, on which account he abstained as much as possible from food; he was free from fever, and the lungs appeared to be sound. He died at a time when the event was least expected.

¹ Cruveilhier, Anat. Path. du Corps Humain, 5ieme livraison, pl. 2.

Sectio cadaveris.—The circumference of the epiglottis was eroded and, as it were, festooned by the effects of ulceration. The superior orifice of the larynx and the mucous membrane covering its posterior face were thickened, ulcerated, and covered with caruncles.

The following case is an example of syphilitic ulceration of the larynx:—

CASE VII.

Sarah Clayton, aged 20, was admitted into the Infirmary, May 8th, with extensive ulceration of the throat. She had had syphilis twelve months previously, which was followed by sore throat and eruptions, and of these she was cured, as she believes, by salivation. She has been under treatment for the existing disease during three months. The patient is much emaciated, passes sleepless nights, can swallow fluids only, has a slight cough, and her voice is reduced to a whisper. She gradually sank, and died six days after her admission.

Dissection.—The cartilage of the epiglottis was denuded at its tip by an ulcer, and there were other ulcers, both on the anterior and posterior surfaces of this organ and on the right vocal cord. Half the soft palate, the velum, and the uvula were completely removed by the ulceration, which likewise extended to the pharynx and the base of the tongue.

It would be useless to detail examples of the ulcerative laryngitis that is so frequently associated with consumption; they must be familiar to every one, and their symptoms differ in no respect from the other forms of ulceration of the laryngeal mucous membrane.

The preceding cases afford examples of most of the forms of chronic laryngitis as it affects the mucous membrane, and it will be observed that the symptoms vary according to the seat of the disease, its progress, and the nature of the morbid changes which it induces in the component parts of the larynx. When a protracted inflammatory process causes a thickened and indurated condition of the lips of the glottis, and when the disease is confined to this situation, the symptoms are such as indicate an obstruction to respiration merely; deglutition is performed with facility, and generally without pain; the voice is at first but little affected, though, when the passage of the air is much impeded, the voice becomes weak and partially suppressed, from the want of a sufficiently rapid current of air to throw the vocal ligaments into vibration; but the characteristic morbid phenomena of such a state of the glottis are uneasy sensations in the larynx not amounting to pain, but sufficient to excite anxiety and alarm, respiration quickened, more difficult, especially towards evening, and the inspirations attended by a wheezing, a hissing, or a whistling sound. The symptoms bear a strong

resemblance to those of œdema of the glottis, and can be distinguished from them only by the absence of soreness in the larynx during the existence of the latter disease, and by the more rapid progress of œdema of the glottis towards a fatal termination. The seat of this variety of chronic laryngitis is the sub-mucous cellular tissue, and ulceration of the mucous membrane is an unusual result.

If a slow inflammation attacks the surface of the laryngeal mucous membrane, respiration is not impeded to the same extent as in the cases mentioned above; but the characteristic signs are a degree of pain and heat in the larynx, a cough, dry and convulsive at first, afterwards accompanied by mucous and muco-purulent expectoration, voice weak and hoarse from the commencement, deglutition rather difficult; general febrile symptoms will often prevail to a considerable extent. If this form of chronic laryngitis is allowed to proceed unchecked, dyspnœa will soon manifest itself, from the increased thickness of the mucous membrane and the infiltration of the sub-mucous tissue; it is, however, but seldom fatal in its earlier stages, for the inflamed mucous follicles rapidly fall into a state of ulceration, which has the effect of relieving the tumid condition of the mucous membrane, and consequently of diminishing the dyspnœa. The occurrence of ulceration is marked by other signs as well as the increased facility of breathing; by loss of voice, for example, if ulcers form on the vocal cords; by painful deglutition if the anterior surface of the epiglottis becomes ulcerated; by inability to swallow liquids if the upper part of the epiglottis is destroyed; and by other local and general symptoms not referable to the existence of ulceration in any part of the vocal organ: as a fetid state of the breath, expectoration of pus, sometimes mixed with small clots of blood, cough attended by a sharp pain at the moment, hectic fever, night sweats, and the other signs of consumption.

The effect of ulceration of the larynx upon the voice differs materially, according to the seat and extent of the disease. If the mucous membrane covering one of the vocal cords only is affected, the voice is rendered raucous and hoarse; if the investing membrane of both vocal cords ulcerates, the voice loses its power and becomes little more than a rough whisper; and if not merely the mucous membrane, but the thyro-arytænoid ligaments are injured or destroyed, the state of aphonia is complete, no proper vocal sound is distinguishable, and a whisper, which is simply an articulation of the ordinary respiration, alone remains. These cases, however, are by no means common. An injury to the thyro-arytænoid muscles by the progress of ulceration, according to Andral, produces a most deleterious effect upon the voice; but ulcers in other situations than those indicated above seem to cause scarcely any change, either in the power or tone of the voice.

Chronic ulceration of the larynx is not productive of much local pain or inconvenience, except when the anterior surface of the epiglottis is affected by the disease, or when the ulcer is situated at the junction of the vocal cords; in the one case the act of swallow-

ing occasions pain, and in the other case coughing and speaking are continual sources of motion in the affected part, and consequently of irritation and soreness. I have frequently made particular enquiries of persons in the last stage of consumption, whose symptoms before death and the post-mortem examinations of whose bodies at a subsequent period showed extensive ulceration of the larynx, as to what pain or uneasiness they felt in the upper part of the throat; and with very few exceptions they have declared themselves unconscious of any, except a little smarting during a violent fit of coughing. Previous to the occurrence of ulceration, there is generally pain, heat, and soreness on pressure; after it is reasonable to suppose that this event has occurred, the pain and heat gradually diminish and then disappear, and a sense of soreness when the larynx is squeezed or roughly handled, together with alteration of the voice in certain cases, give the only indications that the disease is not eradicated. These observations, I should remark, refer more particularly to that indolent form of the disease which accompanies pulmonary phthisis; at the same time they would require but little modification to adapt them to all the other forms of ulcerative chronic laryngitis.

Diagnosis.—The symptoms of chronic inflammation of the mucous membrane of the larynx are very similar to those of acute laryngitis; they differ more in degree than in character. Pain in the upper part of the throat, a sense of constriction, cough, and eventually signs of suffocation are found in both varieties, but in the former they are slower in their progress, and infinitely less distressing throughout.

There are but few diseases with which chronic laryngitis is liable to be confounded, and the most important part of the diagnosis consists in ascertaining the exact nature of the inflammation, and the existence or non-existence of those complications which would influence the treatment, or would render hopeless all attempts at effecting a cure; I refer to the syphilitic origin of the disease, the presence of tubercles in the lungs, and the extensive destruction of the cartilaginous parts of the larynx, as these circumstances would materially affect both the mode of treatment and the prognosis. The investigation of the two first points must be made by means with which every surgeon is conversant; of the last I shall have occasion to speak when treating of chronic laryngitis affecting the cartilages. Chronic inflammation and enlargement of the tonsils may be distinguished from chronic laryngitis, by the great difficulty of swallowing that exists in the former disease, by an inspection of the fauces, by the character of the voice, and also by the absence of cough. Tumours growing from some part of the internal surface of the larynx, and obstructing its calibre, have occasionally been mistaken for the effects of chronic laryngitis, and where no external projection is visible or appreciable by the touch, the diagnosis becomes difficult. The pressure of an aneurismal or other tumour upon the trachea will often give rise to dyspnœa

and symptoms of impending suffocation, which it is not easy to trace to their real source. Mr. Lawrence, in his paper on "Some Affections of the Larynx, &c.,"¹ mentions the case of a young woman who, for about a fortnight, was subject to "a great difficulty of drawing air into the chest, amounting to a sense of suffocation, coming on in fits, between which she was free from all complaint," and who died suffocated. The cause of these symptoms was an aneurism of the arteria innominata, situated behind the first bone of the sternum and pressing on the trachea; the area of which tube, however, it diminished but in a very slight degree. In the *Edinburgh Medical and Surgical Journal*,² there is a still more curious case. A young lady, aged 15, was seized, without any assignable cause, with extreme difficulty of breathing, accompanied by no symptoms of fever excepting a greatly accelerated circulation. Deglutition unimpeded. The poor sufferer was bled and blistered without relief, and died in eight days from the commencement of the attack. For three days before death, the lines were quite purple, and the heart palpitated violently. A post mortem examination showed the trachea, for an inch and a half in length of its middle portion, to be contracted more than two thirds of its diameter; but there was no inflammation or other disease of any part of the trachea. The contraction relaxed gradually after the tube was slit, so that the day following the parts did not appear any longer contracted, or in a state of disease of any kind.

Should cases similar to these again occur, the absence of fever and of cough would at once show that the distressing symptoms were not caused by a chronic inflammation of the larynx. The same considerations would guide us in distinguishing aphonia produced by ulceration of the larynx from that which is the result of hysteria. In hysterical aphonia there is no pain or heat in the throat, and the loss of voice is complete, except at occasional intervals of excitement, when the speech suddenly returns. This can never happen in chronic laryngitis, where the aphonia is the result of disorganization of some of the structures of the larynx.

Causes.—The most ordinary causes of chronic laryngitis are exposure to cold and damp, especially when these are combined with strong and frequent exertion of the vocal powers. The habitual and intemperate use of ardent spirits is said to be another cause of this disease; and according to Mr. Lawrence, Mr. Porter, and Mr. Wood, the action of mercury leads to a state of system in which chronic laryngitis is very apt to occur; debilitating diseases generally appear to act as predisposing causes of this laryngeal affection.

Phthisis pulmonalis must be considered as one of the most frequent causes of chronic laryngitis, whilst, at the same time, it seems probable that the latter disease, by the disturbance of the respiration

¹ Medico-Chir. Trans., vol. vi., p. 227.

² Vol. ii., p. 269.

and by exciting frequent fits of coughing, may cause the development and accelerate the progress of tubercular disease of the lungs in those who are rendered liable to it by constitution or by hereditary predisposition.

The frequency with which chronic laryngitis and its most usual result—ulceration of the larynx—are found to exist in combination with suppurated tubercles of the lungs is so great, that it can in nowise be viewed as an accidental circumstance. Ulceration of the larynx occurred in one fourth of the cases of phthisis examined by M. Louis,¹ ulceration of the epiglottis in one sixth, and ulceration of the trachea more frequently than either. This author also affirms that he has only found three cases of ulcers of the larynx in one hundred and eighty individuals dead of other diseases besides phthisis; and that, in two of these three, there were tuberculous excavations in the lungs, although the patients fell victims of other diseases; “whence it follows, (he proceeds to say), that we must consider ulceration of the larynx as a lesion peculiar to phthisis.”

Andral² admits the existence of idiopathic chronic laryngitis, and that it will alone produce the symptoms of consumption, but he considers such cases to be exceedingly rare. He speaks of the frequency with which chronic laryngitis accompanies phthisis, but gives no definite numbers.

I had the opportunity of examining the bodies of twenty-three consumptive patients during the year 1835, and in ten of them only was any degree of ulceration found in the larynx. Of the twenty-three cases seventeen were men, and the remaining six women; of the ten in whom ulceration of the larynx was found, six were men and four women. In all the ten cases one or both vocal cords were ulcerated; in six of them the ulcers were confined to one of the vocal cords. Ulcers were found on the epiglottis four times.

Syphilis is another and a very frequent cause of chronic laryngitis, and especially of the ulcerative form of the disease; in the latter case the ulcers sometimes extend from the tonsils and pharynx by continuity of surface to the laryngeal mucous membrane. According to Mr. Carmichael,³ venereal ulceration of the larynx occurs only as the consequence of the *phagadenic* venereal disease. He also thinks that the ulceration always propagates itself at its edges by continuity of surface from the fauces to the pharynx, and thence to the larynx.

With respect to the influence of age and sex in predisposing to this disease, I should say, from my own experience, that the middle period of life, from twenty to forty years of age, is the season at which chronic laryngitis most frequently occurs, and that the number of females attacked by it is infinitely greater than that of males, but in what proportion I am unable to state.

¹ Sur la Phthisie, p. 48.

² Clinique Medicale, tome ii., p. 220.

³ Treatise on the Venereal Disease, 2d edit., p. 174.

Pathology.—The effects of chronic laryngitis upon the mucous membrane of the larynx have been already detailed in the cases of the disease which have been given in the former part of this chapter. They vary according to the nature and the seat of the inflammation. Increased vascularity of the lining membrane and deposition of albuminous matter in the sub-mucous tissue are amongst the most ordinary effects of chronic laryngitis; these, unattended by ulceration, indicate an early stage of the complaint, but, owing to the disease being of itself a very infrequent cause of death, we have seldom the opportunity of seeing the organ in this stage.

When the inflammation has continued for a considerable time, the mucous membrane covering the entrance of the larynx assumes a granular condition: it often possesses its natural pale colour, but the surface is rough, irregular, and hardened. The vocal cords are not liable to this morbid alteration, as far as my own observation goes, probably on account of the strictness of the connection between the vocal ligament and the investing membrane; but those parts of the larynx where the sub-mucous tissue is lax and at the same time abundant, as the lingual face of the epiglottis and the arytaenoido-epiglottic ligaments, are very liable to this morbid change as the result of chronic inflammation. When the induration and thickening have not proceeded so far as materially to interrupt the passage of the air, and the inflammatory action has been arrested in its course, very little inconvenience accrues to the patient; the chief indications of such a condition of the glottis are, an alteration of the voice, the tones of which are rendered habitually hoarse and discordant, and an increased liability to suffer from a renewal of the same disease, and to suffer from it far more severely than others, owing to the already narrowed state of the superior aperture of the glottis, and the slight increase of thickening which is necessary to convert dyspnoea into strangulation. It is to this form of chronic laryngitis that those persons are liable who are much addicted to the use of ardent spirits, and those also who are constantly exposed to every variety of weather, and whose occupation requires of them a frequent and powerful exercise of their vocal powers, as hackney-coachmen and hawkers of fish, vegetables, &c.

The chief difference between the pathological effects of chronic and acute laryngitis is, that in the former the exhalent arteries of the sub-mucous cellular tissue pour out, in consequence of the inflammatory action, coagulable lymph, which gradually becomes organised, and imparts that thickening and induration to the sub-mucous tissue which forms so prominent a feature in the cadaveric appearances. In the acute form of laryngitis, the exhaled matters are of a serous or sero-purulent nature.

Ulceration of the mucous membrane is one of the most common results of chronic laryngitis, and especially of that variety in which the force of the disease falls more upon the surface of the membrane and its muciparous follicles, than upon the sub-mucous tissue. The frequency with which ulcerative laryngitis is associated with pul-

monary phthisis gives us numerous opportunities of observing this morbid alteration in the larynx; and whether the ulcers are the result of phthisical or idiopathic laryngitis, the appearances they present are in both cases so similar, that no distinction need be made in describing them.

Their size is very variable, and is probably dependant on the length of time which the disease has continued; they may be as small as a mustard seed, or they may extend over the greater part of the internal mucous surface of the larynx.

Their shape varies considerably, but partakes almost universally of an irregularly rounded figure. The smaller ulcers are always nearly round, and the larger ones are, in most instances, formed by the union of several of the minuter kind.

With regard to the situations where they are most commonly found, in phthisical patients, the vocal cords and the reentrant angle of the thyroid cartilage seem to be the places where ulcers occur with the greatest frequency; in idiopathic chronic laryngitis, the boundaries of the superior aperture of the larynx are most subject to their ingression. At the same time there is no spot throughout the whole extent of the inner surface of the organ, where ulcers have not been discovered.

The depth to which they penetrate varies as much as their form and situation: shallow ulcers are sometimes seen of great extent; and, again, small rounded ulcers are found which have even penetrated the thyroid cartilage. It is very common to find the thyro-arytænoid ligaments exposed; less so to find them injured. The anterior part of the arytænoid, and the upper margin of the thyroid cartilages are often laid bare, but they generally maintain their healthy colour and glistening appearance. In one patient, who died of phthisis, and who had suffered from chronic laryngitis for at least four months previous to death, the thyro-hyoid membrane was perforated by an ulcer just above the thyroid notch, and the ulcerated aperture communicated with a cavity in front of the larynx containing pus, and in which the superior margins of both alæ of the thyroid cartilage were exposed, but still bright and apparently uninjured. In this case, both thyro-arytænoid ligaments were exposed by ulcers, but the voice, though rendered raucous and very hoarse, was not extinguished.

In another case, the patient, a man, aged 45, had had an attack of chronic laryngitis, fifteen months previous to his death; from this he had recovered, and in two months afterwards the same disease recurred, followed by symptoms of confirmed phthisis, of which he died. The voice for some months previous to death was merely a whisper. *Dissection.*—The right ventricle of the larynx was ulcerated throughout. The left vocal cord exhibited an anomalous appearance: there was a small pit on the internal and inferior part of the cord, of the colour of healthy mucous membrane, occupying the bottom of which were seen the thyro-arytænoid ligament and muscle in the middle third of their course, covered,

as it seemed, by a thin transparent membrane. There can be little doubt, I apprehend, that this was the result of an ulcer, which had formerly existed in this situation, and which had healed without reparation of the mucous membrane: in all probability this ulcer was formed at the time of the first invasion of the disease, fifteen months previous to death.

Sometimes, but very rarely, the thyroid cartilage has been perforated by an ulcer: Andral¹ mentions an instance in which the reentrant angle of this cartilage was perforated just above the insertion of the vocal ligaments, at the same time remarking that, as far as his own experience went, it was a solitary example. In this case the voice was preserved.

The extension of the ulceration to the thyro-arytænoid ligaments occasionally causes their destruction; if this occurs on one side only, the voice is rendered very hoarse and rough, but some degree of vocal resonance remains; but if both ligaments are destroyed or much injured the voice is absolutely extinguished. Louis met with this latter result in two cases only.

Ulceration of the mucous covering of the epiglottis, as before stated, is found in about one sixth of the persons dead of phthisis, and it is worthy of remark that the ulcers are observed, with very few exceptions, on the inferior or laryngeal surface only. Sometimes they extend to the edges, and render the margin of the fibro-cartilage uneven and notched; in some rare cases the whole organ is destroyed.² In venereal ulcerations of the larynx, where the disease seems occasionally to be propagated by extension from the soft palate and tonsils to the pharynx, and thence to the larynx, the superior or lingual surface of the epiglottis is more frequently found ulcerated.

The mucous membrane in the immediate vicinity of ulcers in the larynx dependant on the existence of phthisis, is generally pale and healthy in appearance, and the sub-mucous tissue is seldom the subject of serous infiltration. In idiopathic laryngitis, which has taken on the ulcerative form a short time previous to death, the margins of the ulcers are commonly found to be injected and rather elevated, and the sub-mucous tissue infiltrated in a greater or less degree.

The base of the ulcers is formed by the subjacent tissues, which of course vary according to the depth the ulcers have penetrated. Venereal ulcers have usually a sloughy base.

In the midst of extensive ulcerations of the larynx which have been of long duration, we often find a number of soft reddish elevations, more vascular than the other parts of the ulcer, and to these the name of caruncles has been given.

I shall defer speaking of the treatment of that variety of chronic laryngitis which affects the mucous membrane, till I have explained

¹ Clinique Medicale, tome ii., p. 204.

² See Louis, sur la Phthisie, p. 254.

the symptoms and pathology of the other form of the disease, in which the cartilages of the larynx also undergo morbid alterations.

II.—CHRONIC LARYNGITIS AFFECTING THE CARTILAGES.

When the cartilages are implicated in chronic laryngitis, this result is, I believe, in most instances, secondary to some inflammatory affection of the laryngeal mucous membrane or its subjacent tissue. The early symptoms of this form of the complaint are, therefore, very similar to those of the disease in which the mucous membrane only suffers; they are, at first, soreness in the region of the larynx, alteration of the voice, cough, and obstructed respiration; these are followed by expectoration of a dark fetid pus, and sometimes by the expulsion, during a fit of coughing, of a portion of the disorganised cartilage. The usual remedies utterly fail in affording relief, and if the patient is not carried off during a suffocative paroxysm, he becomes worn out by the cough and the incessant dyspnoea, and dies from hectic and emaciation. To this species of disease the name *phthisis laryngea* is peculiarly applicable.

I shall offer three examples of this affection of the different cartilages of the larynx, in illustration of the usual progress and termination of such cases: in the first of these the arytaenoid cartilages and the epiglottis exhibited the most striking morbid alterations; in the second the cricoid, and in the third the thyroid and cricoid cartilages, and the rings of the trachea, were the chief subjects of the disease.

CASE VIII.

William Potter, aged 28, blacksmith, came into the infirmary on the 1st of May, 1835, with symptoms of chronic laryngitis, under which he had been labouring nearly four months. The complaint began at first like a common catarrh, with a great degree of hoarseness, and afterwards pain in the throat and cough. Till the time of his becoming ill, the man had lived very freely and worked hard, and had been exceedingly stout and muscular. When he came into the infirmary, emaciation had taken place to a great extent, he had a quick pulse, constant thirst, and night sweats; respiration generally unimpeded, but sometimes attended with a stridulous noise; pain and soreness in the situation of the larynx; frequent and irritative cough; voice a rough whisper without any vocal resonance; he had no difficulty in swallowing, but some pain during the act. The patient has never had any syphilitic affection.

A blister was put over the upper and front part of the neck. On the 9th of May he was attacked with erysipelas of the face, which began upon the nose and spread all over the upper part of the face

and forehead. The erysipelatous affection seemed to have no connection with the blister. He died comatose during the night of the 17th.

Dissection, thirty-four hours after death.—The body was much emaciated; vesication still apparent on the cheeks; the limbs were streaked with dark lines in the direction of the subcutaneous veins.

All the organs of the body were flabby and semi-decomposed. There were no marks of disease in the abdomen, and very little in the chest. The lungs were emphysematous at their inferior edges, and were connected with the costal pleura by some old cellular bands: they contained no tubercles. The mucous membrane of the trachea was reddened throughout most of its extent. The larynx presented a considerable mass of disease: in the first place, the cartilage of the epiglottis, with the exception of a small central portion, was gone, but the mucous membrane remained, thickened, and irregularly lobulated. The superior aperture of the glottis presented much the same condition of the investing membrane; in neither situation was there any ulcer. Both thyro-arytænoid ligaments were completely destroyed, the interior edges of the rima glottidis forming the boundaries of ulcers which occupied the whole of the ventricles of the larynx on each side. The left arytænoid cartilage was gone; a small ossified and carious remnant of the right arytenoid still retained its situation. Below the vocal cords there was no further ulceration, except a superficial one in the trachea. The head was not opened.

Remarks.—This case, of which I could not procure more accurate notes, as it occurred in the practice of another surgeon, seems to have been an example of what is called laryngeal phthisis. There was chronic inflammation of the larynx, with extensive ulceration of the mucous membrane, and destruction of some of the cartilages, frequent cough and hectic fever during life, and no tubercles in the lungs. The patient had become extremely emaciated from the effects of the laryngeal disease, and, there can be but little question, would soon have fallen a victim to it had not the erysipelas put a stop to life; for without doubt he died of the latter disease, although the post mortem examination was not carried far enough to prove it incontestibly. The symptoms in this case, as far as they are known, are completely accounted for by the autopsy. The loss of voice, for example, by the ulceration and destruction of both vocal cords; the cough and occasional stridulous respiration, by the inflamed and irritable state of the larynx generally; the absence of difficulty in swallowing, by the membranous remains of the epiglottis being sufficient entirely to cover the superior opening of the larynx.

CASE IX.

John Rogers, aged 9, errand boy, was attacked by fever of a typhoid kind on the 5th of October, 1835. The intellectual func-

tions were greatly disturbed, but the vascular excitement was not considerable. This boy, after the usual remedies, seemed convalescent, and I intended taking my leave, when, on the 14th, he was seized with symptoms of croup. Pulse quick and small; breathing difficult and sonorous; frequent, dry, and ringing cough. The mercurial treatment was actively employed, but without affecting the mouth or producing any alleviation of the symptoms. The patient died suffocated on the morning of the 18th.

Dissection, twenty-four hours after death.—On opening the chest, there was very little collapse of the lungs, showing some obstruction to the passage of the air. The mucous membrane of the trachea and bronchi was pale and healthy. The lips of the glottis were approximated so closely to each other by serous infiltration of their sub-mucous tissue as nearly to close the opening. The cricoid cartilage had a dull appearance, and was evidently dead; it lay loose in the cavity of an abscess which had opened into the pharynx, just external to the left arytaenoid cartilage. The cellular tissue in the vicinity of the cricoid was in a sloughy state.

Remarks.—The propriety of ranking this case amongst those of chronic laryngitis appears questionable, but we may reasonably conclude that the necrosis of the cricoid cartilage was occasioned by a slow inflammation and consequent purulent deposition in the cellular tissue around it, and that this had been going on for many days previous to the occurrence of the croupal symptoms. The proximate cause of death was the œdematous state of the glottis, which was itself occasioned, in all probability, by the irritation of the abscess round the cricoid cartilage.

CASE X.¹

Richard O'Leary, aged 32, a sailor, admitted into the Meath Hospital, July 15th, 1825.

He appears to breathe with great difficulty and considerable muscular exertion; respiration attended with a hissing sound; voice hoarse, with a peculiar ringing tone; no cough, but there are severe spasmodic exacerbations every night. The disease under which he suffers appeared about eight weeks since.

Mercury was exhibited, but without affecting the mouth: he gradually became worse, and on the morning of the 25th appeared to be in danger of instant suffocation. His voice was altogether gone, and his breathing could be heard at a very considerable distance. There was slight soreness in the situation of the thyroid cartilage.

Tracheotomy was now performed with relief to the patient, and he appeared to be doing well, when an abscess formed in the front of the neck, which, on being opened, was found to communicate both with the larynx and pharynx.

¹ Porter's Pathology of the Larynx and Trachea, p. 170.

On the 10th of August, sixteen days after the performance of tracheotomy, he was suddenly seized with convulsions, and died almost instantaneously.

Dissection, eighteen hours after death.—The thyroid cartilage lay like a foreign substance, denuded, mortified, and abominably offensive in the abscess in front of the larynx. The front of the cricoid cartilage and of the two upper rings of the trachea had been removed by mortification also. The lining membrane of the larynx was thickened, ulcerated, and had a granular appearance. The tracheal membrane was also thickened, vascular, and in many places covered with patches of flaky lymph.

It is needless to adduce further examples of ulceration and necrosis of the cartilages of the larynx: those already given sufficiently illustrate the usual course of these affections. I have already mentioned that ulceration of the cartilages which is caused by extension of a similar diseased action from the mucous membrane of the larynx. In Dr. Latham's case, appended to Mr. Lawrence's "*Essay on Affections of the Larynx*,"¹ "there were found two distinct ulcerations through the substance of the thyroid cartilage, which contained pus and communicated with the cavity of the larynx." The fibro-cartilage of the epiglottis has, in numerous instances, been indented by the progress of ulcers having their commencement in the mucous membrane; and in the case of Potter (page 77) it was destroyed, with the exception of a small central portion. In the same individual one of the arytenoid cartilages was in a carious state, and of the other no trace remained; so that, in all probability, it had either been quite annihilated by ulceration, or so much loosened from its attachments as to be rejected by coughing.

These cartilages are not unfrequently diseased; the loose cellular tissue by which they are surrounded is more obnoxious to attacks of inflammation than any other part of the vocal organ; the deposition of pus in their immediate vicinity destroys their connection with this cellular tissue, from which they chiefly derive their nutrient vessels, and in consequence they become carious or undergo necrosis.

The cricoid cartilage is, however, oftener the subject of disease than any other. Mr. Lawrence, in his first case,² wherein chronic laryngitis existed, found after death a small internal aperture under the glottis, at the back of the larynx, leading into a cavity on the outside of the membrane, which contained one half of the cricoid cartilage, completely bare and loose." The subject of this case had undergone severe salivation. Dr. Graves and Dr. Stokes³ remark, that, in broken down constitutions, where large quantities of mercury have been used, chronic laryngitis is very apt to terminate in ulceration of the cartilages.

¹ Med. Chir. Trans., vol. vi. p. 260.

² Loc. cit., p. 226.

³ Dublin Hospital Reports, vol. v., p. 82.

Mr. Porter narrates four cases of disease of the cricoid cartilage which proved fatal at various periods, from three months to two years. M. Cruveilhier¹ mentions five similar ones, four of which fell under his own observation.

Necrosis of the thyroid cartilage I believe to be far less common, and perhaps this is to be attributed to its being less in contact with the mucous membrane than either the cricoid or arytaenoid cartilages.

Whenever mortification of the cartilages takes place, abscesses are invariably found in the immediate neighbourhood of the diseased structure; generally they have discharged their contents either into the larynx, pharynx, or œsophagus, and the extreme fetidity of the expectoration, together with dyspnœa, and soreness in the laryngeal region, afford the only diagnostic signs by which these affections can be distinguished from the other forms of chronic laryngitis.

Redness of the secreting surface of the mucous membrane is not mentioned in the description of these cases, wherefore we may conclude that the inflammation is confined, or nearly so, to the sub-mucous tissue; pus is deposited within its meshes, the perichondrium becomes loosened, and the cartilage perishes.

Independently of the effect of large quantities of mercury in predisposing to this affection, typhus fever, and other debilitating diseases, seem also to induce similar tendencies. The age of most of the patients has been within the limits of twenty-five and thirty-five years.

Treatment.—The treatment of chronic laryngitis must be varied according to the nature and seat of the disease, the causes which have induced it, and the different complications with which it is found associated. In that form of the disease where the mucous membrane and its subjacent tissue are simply inflamed and thickened, our efforts must be directed towards arresting the inflammatory action in the first instance, and afterwards we should endeavour to remove the effects of the inflammation—the serous or albuminous deposits within the sub-mucous tissue—which prove a constant impediment to respiration, and impair the strength and tone of the voice.

This species of chronic laryngitis, if early attended to, admits of a tolerably certain and speedy cure; but if neglected in the first instance, or if the causes which produced it are continued or frequently renewed, relief from the most pressing symptoms may be obtained, but a complete restoration of the voice and a return to a perfectly uninterrupted state of breathing cannot be expected. The remedial measures consist chiefly of the abstraction of blood, counter-irritation, and such medicines as promote the natural secretion of the inflamed membrane and the absorption of any adventitious deposit within the sub-mucous tissue. Absolute

¹ Diction. de Médecine, art. Laryngite.

silence must be enjoined and rigidly enforced, for in every stage and in every variety of this disease the symptoms will be rendered more grave by indulgence in conversation.

General bleeding will seldom be necessary, but it may be practised with advantage where there is much fever or violent disturbance of the circulatory or respiratory functions, and in cases of congestion of the brain or lungs from a constant but slight obstruction to respiration.

Local detraction of blood by means of leeches applied in the neighbourhood of the larynx, is a remedial measure of great power in this disease, and should not be omitted under any circumstances. Partial relief is almost invariably afforded, oftentimes it is not of long continuance; but the leeches applied repeatedly in small numbers, and at intervals of two or three days, will effect a considerable amelioration of the symptoms, especially of the pain and heat in the laryngeal region.

Counter-irritation, by means of blisters, tartar-emetic, issues, or the actual cautery, as recommended by some French authors, acts beneficially in putting a stop to the internal inflammation, and particularly in relieving the tendency to spasm of the muscles of the glottis.

The local application of the steam of hot water, by means of inhalation, soothes and alleviates the inflamed parts, and, by causing secretion to take place from the mucous surface, occasionally affords considerable relief.

These are the only external remedies upon which any reliance can be placed, but they may be aided by internal medicines of great power, as, for example, tartarised antimony and mercury. The former of these, given to the extent of producing nausea, exerts a very beneficial effect upon the disease in question; it lowers for a time the tone of the system, diminishes the number of the respiratory acts, and increases expectoration: it acts in a negative manner, also, by destroying the appetite and the inclination to talk.

Mercury is of more service in this than in the acute kind of laryngitis, because there is generally time for it to act; it should be given to an extent sufficient to cause some soreness of the gums, and, very soon after this effect is produced, we shall observe a notable change in the symptoms; if there has previously been much constriction in the top of the throat, much difficulty in the act of inspiration, these symptoms will undergo immediate improvement. This is not the place to discuss the manner in which mercury acts, but from the great relief obtained by the use of this medicine we may reasonably conclude that it reduces the thickened condition of the superior aperture of the larynx or of the rima glottidis, by causing the absorption of any albuminous or serous effusion that may have taken place beneath or within the mucous membrane in these points. Although mercury acts thus speedily and thus beneficially on the disease in question, there are circum-

stances which would lead us to defer its use, and even in some individuals to abstain from it altogether. If pulmonary phthisis is actually developed, there will seldom be occasion for it, as the laryngitis so soon terminates in ulceration, when the most distressing symptoms, as dyspnœa and orthopnœa, most commonly disappear. But there are persons who, by conformation or hereditary predisposition, are liable to be attacked by phthisis; in individuals of this stamp we should abstain from the employment of mercury, for fear of inducing that most formidable of all diseases. In constitutions already shattered by syphilis and its remedy, mercury, any farther use of this medicine should be abstained from; in such cases we must chiefly rely upon country air, a nutritive diet, and sarsaparilla, together with the occasional application of leeches and counter-irritation.

When these remedies fail in affording relief, and symptoms of approaching suffocation present themselves, we can no longer hesitate in having recourse to tracheotomy; but the question as to the necessity, or as to the time of performing this operation, is very different in the chronic to what it is in the acute form of laryngitis. Unless in the case of neglect on the part of the patient, or of great disorganisation in the structure of the larynx affected by the disease, we may generally produce such decided benefit by the active adoption of the above mentioned measures that it will be unnecessary to have recourse to this operation. In chronic laryngitis, therefore, tracheotomy should be considered as a last resource.

The two following cases afford examples of the cure of chronic laryngitis by leeches and mercury.

CASE XI.

April 3d, 1835. I was called to Sarah Martin, a married woman, aged 30, who had been suffering many days from a teasing and incessant cough, unattended by expectoration; the voice was very hoarse, respiration quickened, inspiration requiring increased muscular effort; the countenance was flushed and anxious; pulse 96; pain and soreness of the throat increased by pressure at the upper and lateral parts of the thyroid cartilage; no difficulty in swallowing. The dyspnœa and cough were much aggravated at night. Twelve leeches to be applied to the sides of the larynx; to inhale the steam of hot water, and to take calomel and opium every fourth hour.

5th. Cough not so frequent but more stridulous; voice reduced to a whisper. Repeat the leeches, and continue the pills.

7th. Salivation is established, and the symptoms are on the decline; the voice is more distinct and the respiration unimpeded; tenderness on pressure in the situation of the thyroid cartilage still remains.

I continued to attend this patient for a few days after the last date,

but the signs of laryngeal disease were all removed, except a slight huskiness of the voice.

CASE XII.

Jane Ellis, aged 22, pearl button maker, has been affected for the last two months with hoarseness, dry cough, soreness about the thyroid cartilage, and difficulty of breathing on taking exercise. She has now a sense of heat and dryness in the throat, which is always relieved by drinking; perfect facility of deglutition, but a little pain occasioned by swallowing hard dry food. She has used blisters and expectorant medicines without relief.

On the 16th of November she began to take two grains of calomel and half a grain of opium three times a day.

19th. Hoarseness rather worse, orthopnœa.

By the 23d the mouth had become slightly affected by the mercury, and the dyspnœa and hoarseness were greatly relieved. On the 28th the system was fully under the influence of the remedy; the voice had regained its natural tone, and there was no longer any dyspnœa or tendency to cough.

Cases of this kind, in which the symptoms are undoubtedly caused by thickening of the lips of the glottis, are always relieved by mercury; they might be multiplied without end, but the above are sufficient to exhibit the powers of the medicine.

It occasionally happens that the disease, though consisting simply of a hypertrophied state of the membrane of the glottis, has been neglected or has been subjected to an inefficient treatment, and in consequence has made such progress that life is in immediate danger from suffocation. It would be wrong to trust to the comparatively slow action of mercury in such cases, and tracheotomy must be performed to relieve the patient from his state of imminent peril, and afterwards mercury may be administered, for the purpose of reducing the thickened lips of the glottis and of restoring the larynx to its healthy condition. Cases in which this plan of treatment has been adopted with success are narrated by Dr. Marshall Hall,¹ Mr. Porter,² and M. Andral.³

Chronic laryngitis with ulceration of the mucous membrane is very rare as an idiopathic disease, though as a consequence of syphilis and of tubercular phthisis it is by no means uncommon. The treatment of simple ulcerative laryngitis must consist in giving absolute rest to the diseased organ; in the application of leeches to the vicinity of the larynx, if there be much heat or soreness present; in the production of counter-irritation, by means of perpetual blisters or a seton; and in the administration of such demulcent and anodyne medicines as will quiet the cough and allay the disposition to spasm of the muscles of the glottis. All the varieties

¹ Medico-Chir. Trans. vol. x. p. 166.

² Ibid, vol. xi. p. 414.

³ Clinique Medicale, tome ii. p. 212.

of ulceration of the larynx are aggravated in their character by the frequent occurrence of spasm of the glottis. The application of a belladonna plaster to the laryngeal region, during the spasmodic exacerbations, has been found by Dr. Graves and Dr. Stokes to have considerable power in relieving this distressing symptom. They have also frequently observed these attacks of spasm to yield to the pediluvium and the exhibition of the ammoniated tincture of valerian, ether, and opium.¹

It is impossible to indicate the exact mode of treatment that will suit every case of ulceration of the larynx; if this lesion occurs as a sequel of continued fever, if the sufferer is of a cachectic habit, or bears strong marks of a scrofulous constitution, it will be proper to combine the exhibition of tonics, a generous diet, and change of air, with the application of counter-irritants, issues, or setons, in the neighbourhood of the diseased organ.

When this form of ulceration of the larynx remains untractable, and the strength of the patient is fast wearing away under the cough and irritation caused by its existence, it has been proposed by some authors to perform tracheotomy, with the view of giving absolute rest to the vocal organs and preventing the constant disturbance caused by the passage of the air over the diseased surface. This is at present, I believe, merely a suggestion, the advantages of which have not been proved. The probable result of such an attempt would be a partial obliteration of the aperture of the larynx and the consequent destruction of the voice; at the same time life might be prolonged at the expense of breathing through the artificial opening in the trachea.

The treatment of ulceration of the laryngeal mucous membrane co-existing with phthisis pulmonalis, requires very little remark. Palliative measures only can be adopted, amongst which the inhalation of sedative vapours and counter-irritation are the most important. Silence must be enjoined to as great an extent as is consistent with comfort in other respects.

In syphilitic ulceration of the larynx mercury is the remedy, and when the constitution is injured by previous disease, and the strength much shattered, it may be used locally only with great advantage, by means of cinnabar fumigations. We shall seldom fail in curing this form of the disease by such measures, though it will sometimes prove very obstinate and require a long continued treatment; if the disorganisation of the mucous membrane has been carried to a great extent, the functions of the larynx will not be restored in their former perfect condition. The following brief abstract of a case of this kind will illustrate some of the foregoing remarks;—

CASE XIII.

April 27th, 1835. Maria Horton, aged 30, gilt toy maker, was admitted into the Town Infirmary with dyspnœa, the breathing

¹ Dublin Hospital Reports, vol. v. p. 83.

accompanied by a croupy sound equally perceptible during inspiration and expiration, cough dry and frequent, voice hoarse, and slight soreness of the throat in swallowing. These symptoms came on a few days ago, after exposure to cold. She states that she has lately been subject to similar attacks.

Leeches were applied twice in the vicinity of the larynx, with temporary relief to the patient, and tartarised antimony was given in nauseating doses, but mercury was abstained from, as there had been, on two or three occasions, a little expectoration of florid blood.

On the 9th of May the patient is described as becoming more emaciated daily; the cough was scarcely audible, and the voice reduced to a whisper. The tartarised antimony was continued and a blister applied to the lower part of the neck, to be kept discharging by savine cerate. The discharge from the blistered surface was very great, and the effect upon the symptoms was also considerable; the croupal noise that had hitherto attended the respiratory act ceased, the cough was better, and the voice partially returned. Towards the end of May, the blister having been allowed to heal, great pain in the laryngeal region came on, and the voice again became indistinct, but upon the renewal of the blister, the pain disappeared, the respiration became perfectly free, and the patient was considered cured, except that a slight cough still remained, and the voice had not by any means regained its clearness of tone.

She continued tolerably well during the summer; she had an habitual cough, and was subject to dyspnœa on taking cold at any time; her voice remained husky and discordant. Leeches were applied two or three times in the neighbourhood of the larynx when the pain in this organ returned, and when the difficulty of breathing was much increased, and relief generally was the result. Still, from the state of the voice, from a certain sense of uneasiness about the larynx, and from the frequent recurrence of dyspnœa, it was evident that disease, probably of an ulcerative nature, was going on in the larynx. In the beginning of October a seton was put in the front of the neck, and was kept discharging for several weeks, but without producing any material benefit. She then confessed that, two years ago, she had contracted a venereal disease, and it seemed probable that this had been the cause of the laryngeal affection. She was ordered blue pill and opium three times a day, and also to fumigate the throat with the vapour of cinnibar; ten grains of which were used three times a day. Salivation was soon produced, and some relief followed, and as the patient herself thought she experienced benefit from the use of the fumigations, they were continued till the end of January, 1836. On account of the appearance of periosteal swellings on the forehead, she took hydriodate of potash for some time; the swellings were soon cured, but in other respects the patient continued much in the same condition.

May 4th. Horton's present state is as follows:—She has slight difficulty of breathing at night when she lies down; occasional cough, which is attended with expectoration of a purulent nature,

sometimes mixed with a dark coloured matter, and coming, according to her own idea, from the throat; a sense of soreness when the angle of the thyroid cartilage is pressed upon, and also a great degree of soreness when she swallows solid food, but none when she takes liquids. No difficulty in swallowing; her voice remains rough and hoarse. The general health is not much affected.

For some time after the last date she continued to take the hydriodate of potash, and was discharged as relieved in July.

At the time of her discharge the respiration was quite unembarrassed, the cough trifling and occasional, the general health good, and the voice sufficiently loud, but it appeared to be composed of two tones—one the natural tone, the other a kind of harsh, grating accompaniment.

Remarks.—There can be no doubt that, in this case, sub-acute inflammation and thickening of the laryngeal mucous membrane existed when the patient was first admitted, and that ulceration, probably of the vocal cords, afterwards took place. We may infer that the disease was of venereal origin from the circumstance of the patient having had a syphilitic affection some time before, and from the relief obtained by the use of cinnibar fumigations and hydriodate of potash. Respecting the effect of the treatment, we may remark the temporary advantage afforded by the leeches and the great utility of the blister at a time when it is reasonable to suppose that ulceration had taken place. The internal use of mercury was not so strikingly beneficial as in the cases of simple hypertrophy of the mucous membrane.

The internal exhibition of mercury will not be advisable in every case of venereal ulceration of the larynx. Where the long continuance of the disease has destroyed the powers of the constitution, or where the accompanying eruptions or ulcerations of the fauces (when these exist) indicate the phagadenic form of syphilis, the full action of mercury upon the system is to be dreaded. In such cases, however, the local application of this remedy is highly beneficial, and its effect upon the diseased larynx may be aided by the internal use of sarsaparilla, hydriodate of potash, and tonic medicines generally.

When laryngitis terminates in ulceration or necrosis of the cartilages, the case is almost hopeless; no direct plan of treatment can be recommended with any confidence, and the efforts of the medical attendant must be made towards alleviating the distressing symptoms connected with the local mischief, and supporting the strength of the patient.

Disease of the cartilages of the larynx causes death in two different ways—first, by inducing a constant cough and purulent expectoration, difficulty of swallowing, hectic fever, and slow but progressive wasting; secondly, by suffocation from an œdematous state of the lips of the glottis, which is caused by the irritation of the inflamed or mortified cartilage.

The first of these morbid states, which has generally received the

name of laryngeal phthisis, requires a mode of treatment similar to that which has been laid down for ulcerative laryngitis uncomplicated with a diseased condition of the cartilages. The repose of the affected organ must be rigidly maintained by abstinence from talking, and by such medicines as will control or alleviate the cough. The process of swallowing must be rendered as easy as possible by the adoption of a diet composed of substances which are soft and at the same time nutritious, such as strong animal broths and jellies. It has occasionally been found necessary to feed the patient entirely through a tube passed into the *æso*phagus;¹ the destruction of the epiglottis, and the consequent inability to swallow liquids, may render such a step advisable, but it can only be so, of course, during the latter stages of existence. The removal of the signs of local inflammation, by the application of leeches, blisters, or issues, to the neighbourhood of the larynx, should be attended to, and the spasmodic affections of the glottis, which occur frequently in the course of the disease, must be combated by the narcotic and anti-spasmodic medicines which have been mentioned before.

The nature of these measures is, however, merely palliative, and their principal object to smooth the passage to the grave. A cure, and that a very imperfect one, can only be expected when the expulsion of the whole of the diseased cartilage has removed the source of the irritation and left the larynx free for the transmission of the air during respiration. This, it may readily be seen, can seldom happen, owing to the disproportion between the size of the cartilages and that of the *rima glottidis*. If the disease is confined to the arytaenoid cartilages, as sometimes occurs, they may be expelled by coughing, and the symptoms of laryngeal phthisis may cease; but, in cases of this nature, we have more to dread from *œdema* of the glottis, or from such an inflamed and tumefied condition of the lips of the glottis as may destroy life by suffocation.

The operation of tracheotomy holds out but little promise of ultimate relief when either of the larger cartilages of the larynx has become the subject of necrosis; for though immediate benefit may, in most cases, be obtained by making an artificial passage for the air below the seat of disease, the presence of the necrosed cartilage, which becomes a foreign body in a confined situation, and consequently a never-ceasing source of irritation, will lead to confirmed and incurable laryngeal phthisis. Of this, the first case in Mr. Lawrence's Essay (before referred to) may be cited as an example: the patient survived the operation eight days, breathed freely through the artificial opening in the trachea, and died at last worn out. On dissection, half the cricoid cartilage, bare and loose, was found in a cavity outside the mucous membrane of the larynx. In Dr. Latham's case (appended to Mr. Lawrence's Essay) tracheotomy was performed by Mr. Bell, and the patient lived five weeks afterwards,

¹ Diction. de Médecine, art. Laryngite, p. 31.

without any amelioration of the laryngeal disease. The thyroid cartilage was ulcerated, and the mucous membrane of the larynx in a thick and puckered condition. Mr. Porter performed the operation twice with temporary benefit to the patients, one surviving it a month and the other sixteen days, but the diseased state of the cartilages of the larynx rendered ultimate recovery impossible.

Taking into account the usually unfavourable results of the operation of tracheotomy, when performed for the relief of extensive disease, either in the mucous membrane or in the cartilages of the larynx, there can still be little doubt as to the propriety of recommending it when other remedies have failed, and when the patient is in imminent danger of perishing by suffocation. For, supposing that we are aware of the existence of great mischief in the larynx, we cannot absolutely make out its extent; life is prolonged by the operation for many days, and occasionally alterations of structure to a considerable amount are repaired, and recovery, though of an imperfect kind, takes place. An instance in which this partial kind of relief was obtained is recorded by Mr. White in the *Dublin Hospital Reports*.¹ Tracheotomy was performed for the cure of chronic laryngitis, and mercury was afterwards administered to the extent of producing ptyalism, but without curing the laryngeal disease, for two years after the date of the operation, the patient continued to wear an ivory canula, and to respire through it entirely. When the artificial opening was closed by the finger, he could expel the air through the glottis and even articulate faintly, but he was never able to take an inspiration by the natural passages. A case attended with similar results is narrated by Mr. Porter.² The patient underwent tracheotomy for the relief of chronic laryngitis, but though he was rescued from impending suffocation by the operation, he did not improve much as to general symptoms or as to laryngeal distress. Seventeen days afterwards, when he attempted to drink, every drop of liquid escaped through the wound, indicating that a communication was established between the larynx and pharynx; this, however, healed in time. Six days after the last occurrence, he expelled through the wound, in a fit of coughing, one of the arytaenoid cartilages, in a state of earthy degeneration. In spite of these and some other unpleasant complications, the man recovered his strength, but could not respire through the natural passage, being always obliged to wear a tube in the front of the trachea. This individual, like the one last mentioned, could speak in a rough, hoarse tone when the tube was closed, but he could not breathe.

¹ Vol. iv. p. 561.

² Ibid, vol. v. p. 546.

CHAPTER IX.

CROUP.

This and the succeeding species of the Inflammatory Diseases of the Larynx are distinguished from all the others by the peculiarity of the product of the inflammation—coagulable lymph—which is, in a large majority of the cases, poured out upon the secreting surface of the mucous membrane. The morbid action, also, in most instances, affects the trachea as well as the larynx, and frequently extends to the larger divisions of the bronchi.

The name *Croup*, by which the disease we are now about to consider is generally designated, both in Great Britain and in France, was given to it, in the first instance, by Dr. Home, and was probably an adoption of the vulgar name of the complaint in Scotland. This author thought that a technical appellation was, nevertheless, absolutely necessary, and proposed that the disease should be called *Suffocatio stridula*, from its leading symptoms, the shrill voice and difficult breathing.¹ The name assigned to it by Dr. Cullen, *Cynanche trachealis*, is the one most usually adopted in this country, though perhaps no disease was ever more loaded with synonyms expressive of its symptoms, its pathological characters, and its fatal nature, than the croup.

Till the publication of Dr. Home's *Enquiry*, in 1765, the disease appears to have been comparatively unknown, or at all events not to have been generally distinguished from the other catarrhal or peripneumonic disorders, although it has probably existed more or less in all ages, as the same productive causes must have operated formerly as they do at the present moment.

The essential and characteristic symptoms of croup are, a short, dry, and frequent cough, with a peculiar ringing sound, which has usually, and not inaptly, been compared to the crowing of a young cock; quickened, laborious, and sonorous respiration; voice at first hoarse or shrill, afterwards suppressed; considerable febrile action; and occasionally, towards the termination of the disease, expectoration of membranous substances.

Croup has been divided, by different writers on the subject, into distinct species or varieties, according to the different views that they entertained respecting its nature: by some, for example, into inflammatory and spasmodic, in consideration of the predominance of certain symptoms; and by others into laryngeal, tracheal, and bronchial, croup; this division having reference to the chief seat of the disease. There can be no doubt that the affection is essentially the same in all cases, but modified by external circumstances in some degree, and more especially by difference of constitution in

¹ An Enquiry into the Nature, &c., of the Croup, p. 34.

the subjects attacked. Croup frequently commences during the night, though in most cases there have previously been some premonitory symptoms, such as shiverings, slight fever, cough, and some degree of hoarseness, which have been at first overlooked, or considered as the effect of a common catarrh. These signs are said, by authors, to constitute the precursory period or catarrhal stage of croup, which exists probably in all cases, but often passes unnoticed on account of the extreme youth of the subjects of this disease and the undistinguishing character of the symptoms themselves; it precedes the acute attack, in some instances, only a few hours, in others three or four days. Vieusseux and Goelis attach great importance to the observation of these precursory signs, an importance they would well deserve if they faithfully indicated the approach of this formidable disease, but such is certainly not the case; however, no precaution can be too great in children, and during any season that croup is epidemic, it behoves us strenuously to watch for every symptom that can assist in enabling us to detect the first onset of the complaint.

At an uncertain time after the commencement of the precursory signs, and, as was stated before, frequently during the night, the disease exhibits itself in its more developed state; the respiration becomes wheezing, sonorous, and rather laborious; the act of inspiration, more particularly, is attended by a noise as if the air were drawn through a metal tube; the cough is dry and loud, sometimes hoarse, at other times shrill and ringing, and after each attack of coughing inspiration is accomplished with more difficulty than at other times; the voice acquires a peculiar sharpness, the pulse is quick and hard; the face flushed and tumid; and a sensation of pain about the trachea is indicated, in young children, by a frequent application of the hand to the throat. The patient exhibits great anxiety and restlessness, frequently desiring to change from place to place, drinks often, and in many cases without any difficulty, and generally lies with the head thrown back, to render the passage to the lungs more direct. After the lapse of a few hours the symptoms subside, and in some instances undergo an extraordinary remission, nothing remaining but the original catarrhal signs, together with occasional cough of the croupy character, and the patient falls asleep. At the period of waking again the attack is renewed with increased violence; the respiration becomes more stridulous, and is performed with greater difficulty, every muscle that can at all assist in the process being called into action; the cough is more frequent, short, and squeaking, in general unaccompanied by expectoration of any kind, but sometimes, after great straining and convulsive efforts, thick glairy mucus or false membranes may be rejected by the mouth, in which case very great relief is instantly experienced. The voice, towards the latter part of this stage of the complaint, is reduced to a whisper; the anxiety and distress, together with a sense of suffocation, become aggravated; the lips and countenance assume a livid aspect, the pulse becomes

smaller, and the patient falls into a state of collapse, which constitutes the third stage of croup.

The period of the commencement of the last stage, or that of collapse, varies considerably according to the severity of the disease, the strength of the patient's constitution, and the influence of the treatment adopted. It is characterised by the signs of approaching suffocation and by general weakness of the circulatory and muscular systems. Respiration is quick and very laborious, inspiration requires great muscular effort, and is attended each time by a dragging down of the larynx and by expansion of the *alæ nasi*; the head is constantly thrown back, and the mouth remains open; the cough is less frequent, but strangulating; the voice generally suppressed; the countenance becomes livid and bedewed with cold perspirations; the pulse is small, quick, and intermitting. Temporary relief is sometimes obtained by the expectoration of albuminous matters, but generally the distressing scene soon terminates either by suffocation, by convulsions, or by the supervention of coma, probably induced by the overloaded state or the deteriorated condition of the cerebral circulation.

This general description shows the usual course of the croup, when unattended by any particular complications, or unchecked by medical treatment. It occasionally exhibits itself in a form much less severe than has here been represented; and again, in other instances, it goes through its various stages with extreme rapidity, scarcely leaving an appreciable interval between its first development and the stage of threatened suffocation. The duration of the disease is subject to considerable variety: in a severe case I have seen it terminate in less than twenty-four hours from the commencement of the genuine symptoms of croup, whilst in others it has continued for ten days, and according to Bricheteau,¹ may even prolong itself till the fifteenth, eighteenth, or twentieth day, without losing the characters of an acute disease. Its ordinary period of termination is from the third to the fifth day. Some authors, as Goelis and Albers, affirm that it may become chronic, and continue in this state for a very long time; but their assertions are not borne out by pathological observations, and unless thus supported, we may venture to disbelieve so improbable a statement. Children who have once been attacked by croup are subject to relapse, and are more liable to the disease than those who have never suffered from it: a certain increased morbid susceptibility seems to remain in the air passages, by which they are rendered more apt to contract the disease when external circumstances favour its origin.

With respect to the inflammatory and spasmodic varieties of croup, I have before stated that this division can refer only to the predominance of either set of symptoms. The nature of the disease is essentially inflammatory, but in weakly, leucophlegmatic

¹*Precis Analyt. du Croup*, p. 285.

children, who are always more subject to nervous affections than the more active and healthy race, it sometimes assumes a spasmodic form, inasmuch as the vascular excitement is comparatively trifling, whilst spasm of the glottis and general convulsions occur frequently during the course of the disease, and the remissions are singularly long and complete. The name, spasmodic croup, has often been given to the asthma of Millar, laryngismus stridulus of Dr. Mason Good—a disease totally different to croup, and of which I shall speak in another part of this work.

The division into *laryngeal*, *tracheal* and *bronchial* croup, according as the inflammatory action affects more particularly any separate part of the aerian canal, deserves some attention, as the distinction is founded upon observation, and as the treatment and the prognosis may be in some measure influenced by the locality of the disease.

Laryngeal croup, or that variety in which the larynx is chiefly implicated, was first distinguished by Jurine, in the essay that gained the prize at the celebrated Concours of Napoleon. According to this writer, it is characterised by the suddenness of its attack and the rapidity of its progress, by the prompt development of spasmodic symptoms, by painful sensations in the situation of the larynx, which are aggravated by pressure, and by the speedy death that ensues, unless the disease is checked by appropriate treatment. Guersent¹ speaks of the same variety of croup, and describes it as chiefly affecting the voice and speech, and as attended by urgent signs of strangulation.

When the inflammation implicates the trachea alone the disease is much slower in its progress, and is preceded by a catarrhal affection of two or three days' continuance; the respiration is peculiarly ringing and sonorous, but the cough and suffocative attacks are not so severe as in the last variety; the remissions are more complete and longer; there is generally less pain on pressure in the air passages, and, towards the close of the disease, membranous exudations are very frequently rejected by coughing.

The bronchial variety is less easily discriminated and more doubtful in character than the others: it is described as commencing with symptoms of catarrh, attended with sibilous respiration and the croupy character of voice, and terminating generally either in death or in the expectoration of a great quantity of thick mucus. Probably it is the same disease as the suffocative catarrh of Laennec, affecting young children.

Of these three varieties of croup the first is the most dangerous, and in this disease generally it may be said, that in proportion to the rapidity with which the several stages follow each other is the risk of an unfavourable termination. Other signs indicative of great danger are, intense vascular excitement, the absence of remission of the symptoms, complications of any kind, the per-

¹ Diction de Médecine, tome vi.

sistance of sonorousness and difficulty of breathing, with a voice either very hoarse or suppressed, the expectoration of a membraniform tube, intermitting pulse, cold sweats, or any symptoms indicating a state of collapse. On the contrary, we should regard as favourable signs, a moderate degree of fever, complete and long continued remissions, the easy rejection of mucous or of membranous concretions, and the return to a natural condition of the voice and of respiration.

Diagnosis.—The symptoms of croup are so peculiar, that it cannot easily be confounded with any other disease, unless by a careless and inattentive observer. From suffocative catarrh it may be distinguished by the absence of remissions in the latter, and by the comparatively trifling degree in which the voice is altered. Patients affected with suffocative catarrh, experience no uneasiness in the larynx or trachea, nor is there the croupal sound in the respiration or cough. Acute laryngitis bears more resemblance to croup than any other disease; but the age of the patient will of itself be almost sufficient to distinguish the two affections: laryngitis is as purely a disease of adults as croup is of children, at least the variations from this rule are remarkably few. The burning pain and sense of constriction in the larynx, the freedom from remissions and nocturnal exacerbations, and from the expectoration of false membranes, in laryngitis, form other marks of distinction. From cynanche tonsillaris, it may be known by the absence of redness and swelling of the tonsils, and by the ease with which deglutition is performed in croup. From the existence of a foreign body in the trachea, this disease may be distinguished by the chief difficulty in the former case being in the expulsion of the air from the chest, owing to the obstruction caused by the extraneous substance, whilst in the latter, inspiration is chiefly affected.

Causes.—It appears to be the opinion of all writers upon this subject, that croup occurs most frequently in the colder regions of the earth, and in those situations more particularly where much moisture exists combined with a temperature generally of a low range. It is in the northern regions of Europe where this disease has been oftenest seen, and where, also, it has been most accurately observed and described; in the damp valleys of Savoy and Switzerland, which are subjected to similar atmospheric influences, it likewise occurs with remarkable frequency. Considering the general degree of cold that prevails in northern climates, the great and sudden changes of temperature that take place, and the storms which so often arise, we can easily comprehend how such regions must favour the development of croup, as well as of other affections of the mucous membranes of the respiratory organs. At the same time the middle and south of Europe are not exempt from it, nor even are tropical countries, though its appearance in the latter situations is exceedingly rare; it has been observed in Italy, in Spain, at Barbadoes, and at Bombay.

With respect to the season of the year at which croup is most

prevalent, there is abundant evidence to show that, although it may occur at any time, it most commonly makes its appearance in the winter months and in seasons that are cold humid, or alternately hot and moist. Humidity of the atmosphere is a more active predisposing cause of croup than cold, according to Michaëlis and Crawford; both of whom mention the discontinuance of the recurrence of the disease when it had been before prevalent, on account of the cessation of rainy weather and the draining of a marshy locality.

Children of an early age are much more susceptible to attacks of croup than those of more advanced years, and at the period of puberty the susceptibility, except in some very rare cases, ceases altogether. Croup seldom attacks infants at the breast: the age at which it most frequently occurs is from one year to eight years old. Caillau has given the age at which children are most liable to this disease, according to the following table:¹

The children attended by Van Bergen, from two to five years.
Dr. Home, from fifteen months to twelve years, the generality from two to seven years.
Crawford, from fifteen months to eight years, the generality from two to eight years.
Rosen, from fifteen months to twelve years, the generality from two to eight years.
Cheyne, from sixteen months to twelve years, the generality from sixteen months to nine years.
Salomon, generally from two to five years.
Michaëlis, generally from two to five years.
Zobel, from the time of suckling to eight years.
Vieusseux, from seven months to ten years.
Bernard, from one to five years.
Pinel, from eighteen months to five years.
Barthez, from two to ten years.
Lucadou, from three to ten years.
Caillau, from eighteen months to ten years.

From this table it appears that, within the experience of the above authors, the croup has been observed only once at the age of seven months, and never at any antecedent period: that it has never occurred at a later age than twelve years, and very rarely at that age; and that it has most frequently attacked children from two till ten years of age.

With regard to the liability of the two sexes, the opinion seems general and well founded that boys are more subject to croup than girls. Jurine, in his unpublished essay on this disease, gives an account of one hundred and nineteen cases, of which number seventy-two were boys and forty-seven girls. Of two hundred and fifty-two cases of this disease, treated by Goelis, one hundred and forty-four were boys and one hundred and eight girls. Of Mr. Rumsey's cases by far the larger number were boys. This pecu-

¹ Bricheteau, Précis du Croup, p. 267.

liar susceptibility of the male sex is probably to be attributed to their more active life, and consequently to the greater degree of exposure they undergo to cold and damp, which are the ordinary exciting causes of the disease; whilst girls generally lead a more sedentary life, and are comparatively sheltered from atmospheric vicissitudes.

Croup has sometimes assumed an epidemic form, and by some writers has been said to become occasionally infectious, but the facts adduced in support of this latter opinion are by no means conclusive, and, reasoning from analogy, we should be inclined to repudiate the supposition.

Many of the eruptive fevers must be classed amongst the predisposing causes of croup, as this disease often arises during their progress, and forms a most distressing and dangerous complication. Small-pox, measles, and scarlatina, I have, in many instances, seen followed or accompanied by croup; of these complications the most dangerous is that of scarlatina; in all of them the croupal symptoms are very much masked by the attendant diseases, and frequently by the inflammation extending from the air passages to the lungs.

Aphthæ, or thrush, may induce an attack of croup by spreading from the fauces into the larynx. I have never had an opportunity of examining the body of a child who had died under these circumstances, but I have known children labouring under this disease in the mouth suffer greatly from dyspnœa, total extinction of voice, and hoarse dry cough, which were indubitably owing to the extension of the pellicular inflammation of the fauces into the larynx.

Relative Mortality.—In the very learned work of M. Double¹ there is a table of the results of the practice of fifty-eight writers who have published their experience in this disease, and it appears that the number of cures is rather more than a third part of the whole. The total number of cases attended by these fifty-eight authors is two hundred and fifty-one, of which eighty-six recovered and one hundred and sixty-five died. The authors are ranged, in M. Double's table, in chronological order, and we are enabled to draw from it the consolatory inference that, owing to the disease and its treatment being now better understood than formerly, the relative mortality in latter times is greatly decreased. The number of cases attended by the first twenty-nine authors was one hundred and forty-eight, of which one hundred and seventeen died and only thirty-one recovered. The number attended by the remaining twenty-nine authors was one hundred and three, of which forty-eight died and fifty-five were cured. So that, in later times, it would seem that the mortality has not amounted to one half of those attacked, whilst at previous epochs nearly four fifths of those affected with croup died.

¹ *Traité du Croup*, p. 479.

Pathology.—The post mortem appearances in the bodies of children who have died from the effects of croup, are now tolerably familiar to medical men; they are very similar in the majority of cases, and consist, 1st, of a tumid and reddened state of the mucous membrane lining the air passages, and particularly the trachea; and, 2dly, of an albuminous exudation or adventitious membrane, or a thick, whitish, and glutinous mucous, covering the whole or part of the membrane of the air tubes.

The condition of the mucous membrane varies according to the violence and duration of the disease, or the stage at which death has taken place. "When the disease has been acute, and has lasted but a few hours, the mucous membrane of the larynx and trachea is reddened and inflamed throughout the greatest part of its extent; in the second stage of this affection the same membrane is still found coloured and its vessels gorged with blood. Lastly, in the third stage, we also sometimes find, beneath the albuminous concretion, some traces of redness."¹ It is not always possible to determine from the results of an examination of the dead body what was the state of parts before the final change took place, and this is especially the case with regard to inflamed membranes; in puerperal peritonitis, for example, which is unquestionably an inflammatory disease, and one the symptoms of which cannot readily be mistaken, how often do we find the peritoneum free from redness. The same observation holds good with regard to inflammation of the skin, the redness which exists antecedent to death vanishing most completely on the occurrence of that event. In some cases of croup observed by accurate pathologists, Albers and Vieusseux for instance, the lining membrane of the air tubes has been reported as quite destitute of the usual appearances of inflammation, but in the majority of cases it is found slightly reddened and tumefied. It happens but very rarely that we have an opportunity of examining the state of the membrane in the first period of croup, before the formation of the albuminous concretion; and it is on this account, in a great measure, that we seldom find any vivid injection of the parts, for the secretion of the lymph weakens the inflammation most commonly, and in the end puts a stop to it entirely. We cannot, therefore, be surprised at the absence of the traces of inflammatory action towards the end of the second or during the third stage of the disease, when, in most instances, lymph has been abundantly poured out. In the three first cases of croup reported by Mr. Porter² death occurred at an early period of the disease, in two of them within thirty-six hours from the time of its accession; and on the post mortem inspection of the bodies no lymph was found in the air passages, but the mucous membrane of the larynx and trachea was very much swollen, pulpy, and red: in one instance the membrane of the larynx was of a bright cherry-red.

¹ Royer-Collard, Diction. des Sciences Médicales, art. Croup, p. 431.

² Pathology of the Larynx, &c., pp. 65, 67, and 69.

The membranous exudation varies as to thickness, consistence, and extent of surface over which it is spread. It is more commonly found in the larynx and upper third of the trachea than in any other situation; and it is less usual to meet with it in the bronchial ramifications than in any other part of the air passages. Bretonneau¹ gives three instances in which the false membrane extended from the epiglottis, without breach of continuity, to the extremities of the bronchial ramifications. Bricheteau² met with two instances of a similar kind; these, however, are far from common. I have seen it extend from the lower margin of the cricoid cartilage to the extremities of the bronchial ramifications. Laennec³ observes that the false membrane is generally found in the larynx, but that it very rarely extends above the glottis; Dr. Thomas Davies, in his lectures, recently published,⁴ remarks that, of six preparations then upon the table before him, nearly every one presents the false membrane also on the inner surface of the epiglottis.

The thickness of the false membrane differs considerably in different instances; generally it ranges from half a line to a line and a half. It is usually found to have its greatest degree of thickness at the upper part of the trachea, becoming thinner as it descends towards the bifurcation, but occasionally we observe just the reverse, and the thickest part of the membrane exists in the trachea, just above its division, as in Cheyne's ninth case.⁵ Home says that he has observed the membrane thickest in the middle of the trachea. It appears, however, that in general it is thinner in the larynx than in the trachea, and in the anterior part of this tube than in the posterior part.

The albuminous concretion is commonly opaque and of a grayish-white colour; sometimes, according to Home and Michaëlis, it is brown or black. Its interior is covered with a tenacious mucus, and the exterior, or that which corresponds to the mucous membrane, is often dotted with minute spots of extravasated blood.

The consistence and tenacity of the membranous exudation vary no less than its other qualities; where it has the greatest degree of thickness it generally has the most tenacity. Its consistence is about that of boiled white of egg, it tears indiscriminately in every direction. It takes a very accurate mould of the organ it covers, presenting a smooth surface towards the inflamed membrane, and a more irregular flaky one towards the interior of the tube. In short, the physical properties of this false membrane have relation to the intensity of the disease, and to the time that has elapsed since its invasion. Thus, when a child dies soon after the com-

¹ *Traité de la Diphtherite*, §156, 158, and 168.

² *Précis du Croup*, p. 294.

³ Forbe's translation, 3d edit., p. 125.

⁴ Page 146.

⁵ *Pathology of the Larynx, &c.*

mencement of an intense croup, a whitish tenacious mucus alone is found, while, in the other and succeeding stages of the disease, the membrane is generally seen fully formed. In the bronchi the tenacity of the membrane is always less than in the trachea; generally it is found as a single cylinder, and occasionally as a series of tubes inclosed within each other in the closest contact, and on making a transverse section of the concretion, concentric laminæ are very apparent; these distinct layers are never seen in the larynx or trachea, but only in the bronchi.

Wherever the membrane is situated, it has but a slight adherence to the tube it lines, being easily detached and drawn out; this is probably owing to a fresh secretion taking place external to the first, which loosens its attachment to the mucous membrane.

In some instances, a gelatinous or puriform matter, of a gray or yellowish-gray colour, is found lining the larynx and trachea instead of a membranous expansion, and this most frequently happens when the disease causes death in the course of a few hours; it seems as though the albuminous fluid had not had sufficient time to solidify and form a membrane.¹ This same kind of secretion is also found in those cases in which the true croupal exudation exists, and is probably the first state in the formation of the false membranes; occasionally this gelatinous fluid contains flakes, apparently of lymph.

With regard to the nature of the croupal secretion, I believe that most authors now agree that it is chiefly, if not entirely, composed of albumen, and that it resembles in structure the lymph that is thrown out by the process of inflammation, on serous membranes. Like this lymph, Albers and Bricheteau think that it may possibly become organised, but I believe no facts are recorded that justify the supposition, and, from the nature of the functions of the air tubes, such an occurrence could not take place to any extent without inducing fatal consequences.

In order further to illustrate the pathology of this important disease, I shall add a few cases that have terminated fatally, together with the results of the post mortem examinations.

CASE I.¹

A girl aged five years, habitually subject to catarrhal affections, was seized at six o'clock in the evening with great difficulty of breathing, and almost total loss of speech; the voice was sharp and hissing (*sifflante*).

2d day. The respiration was more difficult; the voice croupal; cough small, frequent, and strangulating; deglutition impossible. The patient lay with the head thrown back, in order to elongate the neck. On the third morning she was dead.

¹ Royer Collard, Diction. des Sciences Médicales.

² Giraudy du Croup, p. 50.

On inspecting the body, a membranous concretion was observed upon the epiglottis, and extending thence two inches down the trachea. The ventricles of the larynx were lined by a similar membrane.

Remarks.—This case, though imperfectly reported, affords a good example of laryngeal croup; the false membrane covered the epiglottis, the larynx and its ventricles, and the upper part of the trachea. The symptoms were chiefly those indicative of laryngeal disease, viz., impeded respiration, voice almost extinguished, and inability to swallow; and death took place in about thirty-six hours.

In January, 1829, I witnessed the dissection of a male infant, aged one year, who died of croup supervening upon measles, in less than twenty-four hours from the commencement of the attack of the former disease. The lining membrane of the larynx and upper part of the trachea was inflamed and greatly thickened by interstitial deposition, and, below the glottis, lymph had been thrown out all over the mucous membrane of the larynx, so as to close the aperture almost entirely.

CASE II.

April 6th, 1835. I was called to John Swasbrick, aged 4. His respiration was quick (forty-four in the minute) and attended by a croupy sound; he had a short, shrill cough, sounding just like the crowing of a young cock; no expectoration. His face was flushed, skin hot, and pulse rapid. The child, a fine healthy little fellow, had, according to his mother's account, had croup twice before, which, in both instances, had been cured by leeches. On the present occasion he had suffered from catarrhal symptoms since the 3d; and in the evening of the 5th the peculiar croupy sound of the respiration was first distinguished. I directed twelve leeches to be applied to the lower part of the neck, a warm bath afterwards, and four grains of calomel every second hour. An emetic was not ordered, as the patient had vomited frequently. There were no traces of false membranes in the ejected matters.

In the evening of the same day, the impediment to respiration seemed on the increase, and the difficulty of inspiring air became greater every hour in spite of the leeches, which bled till some degree of faintness was induced. He died at ten o'clock in the morning, after passing a dreadful night; a short time before death, convulsions came on. The duration of the disease was, from the first catarrhal symptoms three days and a half, and from the commencement of decided croup thirty-eight hours.

Dissection, twenty-five hours after death.—The body was fat and well nourished. On opening the chest, the lungs did not collapse in the least, but remained in contact with the parietes. The lungs were rather paler than natural, and in two or three places on the upper lobes of both lungs patches of superficial

emphysema, of an inch and an inch and a half in diameter, were observed. In the left lung, just beneath the pleura, there was a patch of ecchymosis as big as a crown piece. The pharynx and tonsils presented no marks of inflammation. The larynx was free from disease, excepting a slight degree of œdema of the glottis. The trachea, throughout its whole course, was of a deep rose colour, and contained a considerable quantity of purulent fluid; there was also a false membrane, or layer of coagulable lymph, which lined the whole of the tube, becoming thicker and more tenacious towards the bifurcation. The same morbid exudation was found in the bronchi; and on the left side it could be traced into all the larger ramifications of the tube, and even where the scissors could no longer follow the diminishing ramuscles, small solid cords of lymph were drawn out. In the right side the morbid exudation had not attained to any distance beyond the primary divisions of the bronchus. In the upper part of the trachea, the false membrane was loosened from the sides of the tube by a secretion of mucus; lower down it was adherent.

Remarks.—This was a well marked case of croup occurring in a stout, healthy child. The albuminous secretion was extensive, consistent, and tenacious, and more abundant in the lower part of the trachea and bronchi than in the upper parts of the tube. In connection with the situation of the lymph, we must observe the ecchymosed and emphysematous condition of the lungs, which sufficiently indicate how great the efforts at expiration must have been. During the last hours of life inspiration was very difficult, and this was, doubtless, owing to the œdema of the glottis. From the great amount of disease in the left lung and lower part of the trachea, it seems probable that the inflammation and deposition of lymph commenced in the left bronchus and then proceeded upwards; and this supposition is borne out by the quickness of the respiration, when the croupy sound was not nearly so loud as I have frequently heard it in cases where the post mortem appearances have been of a much milder character.

CASE III.

On the 16th of March, 1832, I was called to Thomas Leek, a very delicate child, aged $2\frac{1}{2}$ years. He was in the last stage of croup, which had attacked him on the 13th, and for the relief of which nothing had been attempted. His countenance was pale and anxious, cough frequent, respiration quickened and accompanied by the croupy sound. Leeches, a warm bath, and calomel were ordered, but the little patient expired the same evening.

Dissection.—The larynx was quite free from inflammation, but in the trachea, immediately below, there was lymph effused in large patches, soft, and but slightly adherent to the mucous membrane beneath, which exhibited no redness. Near the bifurcation more lymph was found, which adhered very firmly to the subjacent

membrane; in this situation the trachea had some increase of vascularity. There was a large quantity of gelatinous fluid in the trachea and bronchi. The lungs were perfectly healthy.

Remarks.—This case affords an example of croup, modified by a delicate constitution; for although the disease had continued unchecked for three days, there was comparatively a slight effusion of lymph, which was soft and in patches, but in its place, a large quantity of a gelatinous muculent fluid, which was probably the result of a feebler inflammatory process than that necessary for the effusion of coagulable lymph.

CASE IV.

January 9th, 1836. Eliza Bell, aged 2 years and 8 months, a child generally enjoying a good state of health, had scarlatina three months ago, but had long since completely recovered from it.

On the 5th of January she was first seized with symptoms of catarrh, which continued unabated till the evening of the 7th, when her breathing became short and sonorous. She now breathes rather quicker than natural, and both inspirations and expirations are accompanied by a loud croupal sound; the cough is short, suppressed, and squeaking; the voice natural; pulse quick; countenance pale and anxious; and the child seems very restless and uncomfortable, but does not complain of pain. Ordered to take an antimonial emetic immediately, and afterwards two grains of calomel and two of antimonial powder every hour for six doses.

This child died about four hours after the first visit. She had rejected a considerable quantity of mucus during the action of the emetic, but was in no respect relieved; the dyspnœa and restlessness increased, and the voice became extinct previous to death.

Dissection, forty-two hours after death.—Body well nourished. All the veins at the root of the neck were distended by dark thick fluid blood. On opening the chest, the lungs collapsed imperfectly; there was a small emphysematous patch on each; they were rather congested, and affected with a slight degree of serous infiltration.

The larynx and trachea were filled with frothy pus of most genuine appearance; no false membrane was found in any part of the air passages. The lining membrane of the larynx, trachea, and bronchi, was swelled and injected, the epiglottis rather thicker than natural.

Remarks.—As this disease first derived its name from the peculiar noise with which it is attended, the case that has just been related is certainly to be ranked amongst those of croup. At the same time the morbid appearances after death indicate the previous existence of an inflammation of the mucons membrane of the larger air tubes, which had terminated in the secretion of pus instead of albuminous matter. Such instances are by no means uncommon.

The four cases narrated in the preceding pages afford illustrations of the chief varieties which the disease exhibits. The first was an example of laryngeal croup. The post mortem inspection shows the false membrane covering the whole anterior of the larynx and the superior part of the trachea; and the symptoms peculiar to this form of the complaint are also well marked, viz., great dyspnœa and almost total loss of speech at the first onset, to which is speedily added extreme difficulty of deglutition. In the second case, the morbid action affected the bronchi and the whole length of the trachea, and caused a copious effusion of coagulable lymph; a hurried state of the respiration and of the circulation were amongst the most prominent symptoms, the powers of speech and of deglutition being comparatively unimpaired. In the third case the disease was of a milder type; the trachea only was affected, its lining membrane but slightly reddened, and the effused lymph was soft and patchy. The last case exhibits that variety of croup in which a gelatinous or a puriform fluid is found occupying the large air tubes instead of coagulable lymph.

All the cases, however various the nature of the morbid lesions discovered after death, were marked by the presence of the croupal sound in the cough or during respiration; this pathognomic sign was equally observed in Case IV., where no false membrane existed in the air passages, and in Case II., where the obstruction from this cause was carried to a very great extent. In Case I., where the larynx was the part most interested, and the trachea affected only at its upper extremity, the respiration was quickened and exceedingly difficult, but the croupal sound is not mentioned as accompanying either of its acts. May we infer therefrom that this peculiar sound is produced by an impeded condition of the trachea? Inflammation and obstruction of the larynx, when carried to a considerable extent, will cause a stridulous or a whistling sound during the act of inspiration: but this differs materially from the true croupal sound, which is heard, also, equally during both the respiratory acts. In the progress of true croup we often have the opportunity of contrasting the different sounds produced by laryngeal and tracheal obstruction, for a spasmodic action of the muscles of the glottis, which immediately causes the former, is productive of a whistling noise in the inspirations, very different to the genuine croupal sound. In Case III., where the larynx was perfectly free from inflammation, and the trachea coated at its upper and lower parts with lymph, sonorous respiration peculiar to this disease existed in its full force.

From these circumstances we may venture to conclude that it is to the inflamed and thickened state of the tracheal mucous membrane, and to the deposition of lymph upon its surface, we must attribute the formation of the sound which distinguishes croup from all other diseases.

Nature of the Disease.—Very little difference of opinion now exists as to the nature of croup; it is unquestionably a peculiar

inflammation of the larger air tubes; peculiar, inasmuch as inflammation may take place in them, which will be attended with very different effects to those found in croup, viz., great increase in the vascularity of the membrane, and a superabundant secretion of the natural mucus of the parts. In the disease under consideration the inflammatory signs are often very trifling, especially when the quantity of lymph is large; but as we know of no circumstances under which this substance is excreted without a previous or accompanying inflammatory process, we may fairly attribute its origin to the same cause in croup, even though a cadaveric inspection may not exhibit the marks of increased vascularity. It is the opinion of some eminent pathologists, and of Andral¹ amongst others, that the effusion of albuminous matters upon the surface of mucous membranes is caused by a sub-acute rather than by an acute inflammatory action, and this derives confirmation from the fact that croup occurs more frequently in delicate, leucophlegmatic children, than in those of stronger constitutions, though in the latter individuals the disease assumes the type of the constitution, and is attended by strong febrile symptoms. In weakly children, the predominance of spasmodic or nervous effects before death, and the occasional absence of membranous exudation afterwards, have created doubts in the minds of some authors as to croup being universally an inflammatory disease, but the very nature of the organisation of these persons renders a most satisfactory reason for both phenomena. Moreover, in strong and plethoric subjects, when depletion has been carried to a considerable extent, we observe the inflammatory type gradually disappearing and the spasmodic effects exhibiting themselves in a marked degree; and Dr. Copland observes,² "even when the first seizure has been of the inflammatory form, yet the relapses or subsequent attacks, which are sometimes repeated several times at irregular intervals, have generally possessed more of the spasmodic character." From these considerations we may safely conclude, that croup is always one and the same disease, but that the symptoms and cadaveric appearances are modified by the habit and organisation of the sufferer.

A disease productive of pathological effects similar to those of croup sometimes occurs in the intestinal canal; and membranes have been passed from the bowels in perfect tubes, and quite half a yard in length; but the symptoms in these cases are not nearly so violent as when the false membrane is formed upon the air passages, on account of the difference in importance of the functions of the respective organs. The fever that accompanies this disease in the bowels is by no means so severe as in common enteritis. For a description of this peculiar affection, See Good's *Study of Medicine*, art. *Diarrhœa tubularis*, and a paper by Dr. Powell in the *Medical Transactions*.³

¹ Pathol. Anat., translation, vol. ii., p. 483.

² Dictionary of Practical Medicine, p. 460.

³ Vol. vi., art. 7.

The inflammation in croup appears, in the first instance, chiefly to affect the cellular tissue that enters into the composition of the mucous membrane, and not the muciparous follicles themselves; and the albuminous exudation is poured out by the secernent arteries of the cellular structure. This is certainly a mere theory and cannot be satisfactorily proved, but the results of the disease differ so essentially from what takes place in the ordinary inflammation of mucous membranes, that they must be owing either to some peculiarity in the nature of the inflammation or in the structure which is the subject of it, and perhaps the latter supposition is of the two the least objectionable. After an uncertain interval, the mucous glands become consecutively affected by the inflammation, and secrete a quantity of their proper fluid, which assists in loosening and detaching the false membrane, and, except in case of a relapse, puts a stop to its further formation.

This disease is sometimes accompanied by inflammation and swelling of the tonsils, uvula, and velum palati, and by the occurrence of membranous films on these parts; Mr. Rumsey¹ observed this in many instances during the time that croup was epidemic at Chesham, in 1794. In the *Angine couenneuse*, or Diphtherite of M. Bretonneau, these effects are always observed, and, according to the opinion of this author, the diphtherite and croup are the same disease. That they are often united it is impossible to deny, and equally so that the latter, or a disease very similar, sometimes originates in the former; but that the seat and the nature of the two affections are different, I think, admits of easy proof; but I shall speak further on this subject when treating of croup in the adult, or the pellicular inflammation of M. Bretonneau.

Many of the aspirants for the prize at the Concours appointed by Napoleon on the subject of croup, thought it advisable to ascertain if the disease could be produced in the lower animals by the injection of irritating substances into the trachea, or by making them inhale the fumes of concentrated muriatic and sulphuric acids, &c. The general results of these experiments were, that inflammation of the air tubes and increased mucous secretion could always be excited, and that occasionally slight membranous exudations were thrown out; that this occurred most frequently in young animals; and that the matters in the air tubes were never sufficient in quantity to obstruct the respiration and occasion death.

Treatment.—In attempting the cure of croup, the indications are: 1st. To diminish the inflammatory action and to allay fever when this is present. 2d. To prevent or put a stop to the excretion of albuminous matters. 3d. To effect the expulsion of any false membranes that have already been formed. 4th. To alleviate spasmodic symptoms and prevent their recurrence: and 5th. To strengthen and support the failing powers during the last stage of the disease.

Several of these indications may be accomplished by the same

¹ Transactions of the Medical and Chirurgical Society, vol. ii., p. 28.

means, and some of them but too frequently require no consideration at all, as, amongst the poorer class of patients, the disease is seldom seen till the stage of collapse has commenced. The mode of treatment must adapt itself, not only to the period of the disease, but also to the varying constitutions of the different subjects.

The first curative intention, that of diminishing febrile and inflammatory action, should be effected by the abstraction of blood generally or locally, if the patient be strong and plethoric, and if the disease be in an incipient state. In the majority of cases, the application of leeches along the course of the trachea will be preferable to general blood-letting, because the disease more frequently occurs in weakly children than in those that are habitually healthy; but when the febrile excitement is great, the face flushed, and the respiration and pulse much quickened, venesection to the extent of producing faintness should be put in practice; for this disease has many strong points of resemblance to inflammations of the serous membranes, and in such complaints the advantages of a full and early bleeding are universally allowed. Very soon after the bleeding, or before, when leeches are applied (on account of the saving of time), a powerful antimonial emetic should be exhibited, which, independently of clearing out the stomach, will generally cause the ejection from the air passages of a quantity of white tenacious mucus, and occasionally of shreds of albuminous matter in a solid state. The respiration will be much relieved for a time by this proceeding, and probably the febrile symptoms will greatly subside; a warm bath may follow the exhibition of the emetic in the one case, or the application of the leeches after the emetic in the other, with manifest advantage. These remedies will constitute the first and more immediately anti-inflammatory part of the treatment, by means of which the disease in many instances will be cut short, and prevented from reaching the second stage.

The second indication, that of hindering altogether, or putting a stop to the formation of false membranes, will, of course, be partly accomplished by the means mentioned above; but the removal of that state of system which causes the generation of these albuminous exudations is the most important part of the treatment. When the lymph thrown out upon the trachea begins to solidify and form itself into a membrane, the disease must be considered as in its second or developed stage; it is at this period that great alarm is excited, and that medical aid is commonly resorted to. At this stage it may be necessary still to have recourse to depletion, if it has not been put in practice before, but more cautiously, and in a local rather than a general manner; and in the abstraction of blood we should always recollect that the nature of the inflammatory action is of the sub-acute kind, and more peculiar than intense, that the subjects of the disease are often of weakly constitution, and, therefore, such as will not bear much bleeding; and that the tendency to spasmodic affections is increased by debility. An active antimonial emetic must also be speedily exhibited, to assist in

expelling from the air passages the accumulating secretions: and from its full action great temporary relief may be anticipated.

The blood obtained by venesection from patients affected with croup should be attentively examined, as, when the inflammatory type is strong, the quantity of fibrine and crassamentum will generally be found to be very considerable, and the urine also, in these cases, will contain abundance of albumen. The occurrence of these circumstances should incline us to practise depletion to a greater extent than in other instances, and to use with greater vigour the other measures within our reach for controlling this state of the system, as the production of false membranes appears to have with it a very close connection. With this view, if bleeding and emetics fail in giving prompt and perfect relief, we must have recourse to mercury. The powers and mode of operation of this medicine are now well understood; they have been so ably investigated and explained by Dr. Farre and others, that I need offer no illustrations on the subject. The ultimate effects of mercury, when given in large quantities, are, to attenuate the blood by destroying its fibrine and crassamentum, and to produce a cachectic state of system utterly incompatible with the existence of adhesive inflammation. If actuated by theoretical views, therefore, mercury is the remedy we should eagerly fly to, and I believe it will be found that the results of practice bear ample testimony to its utility in this disease. Dr. Rush, of Philadelphia, was the first who made use of this medicine, and with the ardour and zeal of a discoverer, he says, speaking of croup, "our principal dependence must be placed on calomel; the bark is scarcely a more certain remedy for intermittents than calomel in the humid cynanche trachealis."¹ Since the publication of Dr. Rush's remarks, many English and foreign writers on the subject have strenuously recommended mercurial remedies, administered either internally or by inunction, or in both ways combined. Calomel is the best form for giving it internally, and the dose must vary according to the violence of the attack and the age and constitution of the patient. At first it should be given in doses of from one to four grains every two hours, till some impression has been made on the symptoms, and afterwards it may be administered at longer intervals. It often cures without producing any particular sensible effects, but in general, after a few doses have been given, the alvine evacuations become frequent and of a green colour, and these signs indicate that the medicine has been absorbed and has affected the constitution. The quantity should then be moderated, for it is seldom necessary to produce ptyalism. Directly that the patient becomes influenced by the calomel, lymph ceases to be effused in the trachea, and though it is doubtful whether the false membrane is ever absorbed again into the system, it soon becomes detached by the secretion from the subjacent mucous follicles, and will be coughed

¹ Medical Enquiries and Observations, vol i., p. 145.

up by degrees. From these considerations it appears that, could the subject of inflammatory croup be got under the influence of mercury before suffocation takes place from œdema of the glottis, or before the rima is plugged up by false membrane, the disease would almost invariably be cured. To expedite this event, therefore, the inunction of mercurial ointment and the application of a blister to the lower part of the neck, to be dressed with the same ointment, are means to be promptly adopted, in addition to the internal exhibition of calomel. In town practice, and especially amongst the pauper classes of the community, bleeding, even by leeches, generally does harm, unless in the very earliest stages of the disease; it weakens the patient, and in most instances without putting a stop to the tracheal inflammation. Of eight pauper cases that I have attended within the last three years, four were bled with leeches and four were not; the latter recovered, whilst the former died. In all the instances, the complaint had been overlooked and neglected, and relief was sought at a very late period; but the circumstances of seven at least out of the eight cases were very similar; the croup was uncomplicated with other diseases, was of the inflammatory kind, and attended by the peculiar membranous exudation. Emetics and mercury were given freely in all the cases; so that we may, I conceive, draw an inference from them unfavourable to bleeding in croup amongst the paupers of a large town. The children affected with this disease that were treated by Rush¹ and Rumsey² with calomel, but without bleeding, were cured in almost every instance. Dr. Home³ denies the possibility of bleeding being of any advantage in the second stage of this disease, or where the purulent membrane is formed. Dr. Cheyne⁴ likewise remarks that, "in the second stage, bleeding has often been largely used, perhaps from not duly attending to the great change that has taken place in the disease." "To a robust child a moderate bleeding may do no injury, but it is proper to say that I have never witnessed any benefit from bleeding in the second stage of croup."

Towards the termination of the second stage, when the inflammatory action may be said to have subsided, when the adventitious membrane is fully formed, and when, from the the great impediment to respiration, the state of collapse is commencing, we cannot trust to mercury. In those exceedingly rapid cases of croup where no stages can be distinguished, and which proceed to a fatal result in twenty-four hours or less, the operation of mercury, unless its exhibition be almost coeval with the accession of the disease, is too slow to merit our confidence. But where the intensity of the morbid action is moderate in degree, where the patient is seen soon

¹ Medical Enquiries and Observations.

² Medical and Chirurgical Transactions, vol. ii.

³ An Enquiry into the Nature, &c. of Croup, p. 57.

⁴ Pathology of the Larynx, &c. p. 57.

after the commencement of the croupal cough and respiration, and where the constitution is feeble, mercury, assisted by an occasional emetic, but to the utter exclusion of bleeding, may be relied on with security.

The following cases illustrate the cure of croup by calomel, almost unaided by any other measures:—

CASE V.

Jane Price, aged 16 months, was seized with small-pox on the 15th of November, 1835; she recovered from this, but continued rather hoarse till the evening of the 1st of December, when she was affected with severe symptoms of croup. Four leeches were applied, and six grains of calomel were given, by some medical man in the neighbourhood. At mid-day of the 2d, when I first saw the child, the respiration was quick and croupal, cough frequent and shrill, voice nearly extinct, countenance rather flushed, and eyes suffused. To take two grains of calomel and two grains of antimonial powder every second hour.

3d. Slept several hours during the night: respiration slower, but still croupal; cough always followed by a long and sonorous inspiration; countenance paler and less anxious; pulse soft. To continue the powders and have a blister applied to the lower part of the neck.

4th. Breathing much relieved; cough looser, but no expectoration; *fecal* evacuations *green*. To take the powders three times a day. From this time the progress towards a cure was rapid and uninterrupted. She was discharged on the 9th quite well.

CASE VI.

December 10th, 1835. Benjamin Francks, aged six years, apparently a strong, healthy boy, had croup last winter. For a week has had a hoarse cough. He now complains of pain in the situation of the trachea; the inspirations are occasionally sonorous, the cough is croupal. Quick pulse, and thirst; no difficulty or pain in swallowing. An emetic was first administered, which brought up no false membrane; but the croupal sound of the cough and respiration were in no respect removed. To take two grains of calomel and two of antimonial powder every two hours.

It would be useless to pursue the history of this case through its details: the mouth became affected by the mercury on the 14th, and from that time all the symptoms of croup disappeared.

CASE VII.

January 3d, 1836. Crispin Reynolds, a stout, healthy child, aged 14 months, still suckled, is affected with incipient croup, of

which the precursory signs commenced seven days ago. Last night the child became affected with croupal respiration and cough; to-day he seems lively and well, except that the breathing is sonorous, and the cough completely croupal. The voice is natural. To take an emetic immediately, and afterwards two grains of calomel and two of antimonial powder every second hour.

On the 4th and 5th, the respiration was more croupal, and the cry hoarse, but the child played about during the day. 6th. All the symptoms are relieved; last night the patient had several very green stools, (as the mother described them, like green paint). Has taken twenty-four powders. To take one three times a day. 8th. The cough still has a croupal character, but is less frequent in its attacks: the respiration natural, and quite destitute of the stridulous sound with which it was before attended. The bowels continue relaxed, and the evacuations are greenish. To omit the mercury, and to take a mixture containing oxym. scillæ and vinum ipecacuanhæ.

In a few days this child was quite free from complaint.

CASE VIII.

July 31st, 1836. John Morton, of healthy appearance, aged 15 months, and still at the breast, broke out with measles on the 22d; they disappeared on the 26th, but the child suffered from severe cough, which to-day has become aggravated. The respiration is quicker than natural, and attended with a slight croupal noise, which the mother assures me is louder during sleep; the cough is not exactly stridulous, but very hoarse, loud, and quite dry. Pulse and skin natural, bowels open; neither pain nor difficulty in swallowing. To have an antimonial emetic immediately, to be put in a hot bath, and afterwards to take calomel gr. iij., p. antim. gr. ij. every second hour.

August 1. The emetic brought away no false membrane, but the little patient is decidedly better to day. The respiration is not so quick, and has very little of the croupy character; the cough is still very severe, dry, and ringing. Eight of the powders have been taken, and each one of them has induced some degree of nausea, and, in two instances, actual vomiting. Bowels relaxed; motions very green. Powders every third hour.

2d. Respiration natural as to time, and unaccompanied by any croupal sound; the cough still loud, dry, and ringing.

3d. Since yesterday the cough has been less frequent, and is quite altered in character, being loose and attended by expectoration, which, however, is always swallowed. The bowels are much relaxed and the gums tender. From this time the medicine was discontinued, and the patient was soon completely restored to health.

Another class of remedies, that powerfully contributes to the fulfilment of the first and second indications of cure, is that of

emetics and nauseating medicines: they have already been mentioned incidentally, but from the great favour in which they are held, and the benefit that so usually results from their action, they deserve particular notice. When given during the first stage of croup, they disembarass the air passages of the gelatinous secretions that clog them, and often produce such a shock to the system as to terminate the disease at once. This shock and the perspiration that follows it, are amongst the most important effects of the remedy; for even when no mucous or albuminous matters are expelled from the lungs during the action of the emetic, the patient is generally much relieved after having vomited. The tartarised antimony is the best medicine of this kind, and it should be given at short intervals till vomiting is effected, after which it should not be discontinued, otherwise the reaction might prove injurious, but nauseating doses must still be administered. When the second stage has commenced, and the disease is fully developed, emetics are useful in bringing the false membranes from the trachea; "they likewise increase the secretion from the mucous membrane of the bronchia, while at the same time they lessen the tone of the arterial system. Hence they are the only true expectorants."¹ In fact, "they fulfil all the indications, whether of arresting the inflammation, and thus of preventing its consequences, and above all the formation of the membrane; or of facilitating expectoration in general, and the expulsion of the albuminous exudation, when it has already begun to form."² Mr. Porter gives five cases, in his work on the Pathology of the Larynx, (from the sixth to the tenth inclusive,) all of which were cured by tartar emetic, without the aid of any other medicine except the loss of blood in one case (the 7th). But it would be in vain to attempt the mention of all the authors who have lauded the virtues of this class of medicines. They appear to be considered by the most eminent of the French writers on this disease, as second only to bleeding and blisters. An examination of the cases in which they have proved successful without much assistance from other remedial agents, shows that the patients were generally weak and delicate children, and that the disease was, in most of the instances, of that kind which is called catarrhal croup, in contra-distinction to the inflammatory. Emetics are most objectionable when the child is fat and plethoric. In such cases they should not be used without the previous abstraction of blood. Their employment might also be hazardous when the second stage is much advanced; for if the lymph in the trachea be loose and unattached, the effort of vomiting may force a portion of it into the rima glottidis, and thus cause death by suffocation.

The third indication of cure is, to effect the expulsion of any false membrane that may have formed. Whether the lymph that has been poured out upon the trachea is ever again absorbed,

¹ Cheyne, p. 51.

² Vieusseux, Sur le Croup, p. 133.

appears to be involved in considerable doubt. Albers¹ affirms that the croupal concretion frequently takes a permanent adhesion to the mucous membrane of the trachea, and that this is a common mode of cure in the disease in question. If it does adhere and become organised, there is every reason to believe that it ultimately undergoes absorption, or we should occasionally have opportunities of witnessing specimens of such results after death, and I am not aware that they have been met with, nor does M. Albers support his opinion by any facts. Vieusseux² has this remark:—"Some authors have regarded the expulsion of the membrane as a means of cure: I have never seen that the cure depended upon expectoration, but only on the diminution of the fever, and, above all, of the symptoms of suffocation. In a word, the chief part of those that get well expectorate nothing, or next to nothing." What then becomes of the lymph? Is it absorbed, or is it expelled by coughing? There is nothing very novel in the idea of the lymph being absorbed, for if any part of it remains in contact with the mucous membrane, it probably will be taken up again by the absorbents, and great part of it is very likely to be expectorated without being noticed, as all the patients are children who, in most instances, swallow their expectoration.

An examination of the trachea of a child who has died during the latter stages of croup generally shows that the lymph is partially detached from the lining membrane by an intervening layer of mucus; and it has, therefore, been considered as an important indication to excite the action of the muciparous follicles, that, by largely secreting their peculiar fluid, they may loosen the adventitious membrane, and render its expectoration easy. This, however, must not be attempted till all fever has ceased, which is generally towards the close of the second stage of croup. The medicines best calculated to act as expectorants in this disease are, the preparations of squills, of senega, and the sulphurets of the alkalies; they should be given in nauseating doses, or even to the extent of producing full vomiting, if the symptoms of suffocation are severe. One great object in the administration of these stimulating expectorants is, to change the action of the mucous membrane of the air passages, to substitute an excessive muculent secretion for the peculiar albuminous exudations that have resulted from the morbid action. The probability of recovery from croup when the false membrane is fully formed must depend, in a great measure, upon the extent of surface covered by the membrane: if it line the whole of the trachea, the chances of a favourable termination to the disease are very trifling; if it be confined to the larynx or the upper part of the trachea more hope may be entertained, especially if the layer of lymph is thin, as it may then easily be expelled in shreds.

If, towards the latter periods of croup, spasmodic affections, either of the glottis or of the extremities, should be added to the

¹ Royer Collard, *Raport sur le Croup*.

² *Sur le Croup*, p. 133.

other symptoms, they must be combatted by the tepid bath, by the inhalation of aqueous or medicated vapours, and by medicines of that class denominated antispasmodics; of these the most powerful are opium, musk, assafœtida, and the oxide of zinc. Opium and assafœtida are the remedies that have received the strongest recommendation by medical authors, but the best authorities seem to entertain a very low opinion of their merits. Cullen never found antispasmodic medicines of any use; Rumsey gave them repeatedly, but they were never of any avail. Vieusseux speaks favourably of assafœtida. Alexander¹ considers them very precarious remedies. Jurine speaks well of assafœtida exhibited by the mouth and by injections, and of sulphuric ether.

When the disease has reached the stage of collapse, either from the patient not having been earlier seen, or from the inefficacy of the measures employed, but little hope can be entertained of accomplishing a cure. To support the strength of the patient, to preserve the declining nervous and vital energies, to relieve spasm, and to induce expectoration, are the indications; and the means of fulfilling them consist in the exhibition of stimulating expectorants and antispasmodics, wine, and nourishing food. The warm bath, with the addition of mustard sinapisms to the legs, and the application of blisters and rubefacients to the chest, may be tried, together with the other means mentioned above, but at this stage of so generally fatal a disease little ultimate relief can be anticipated.

If the attack of croup, instead of being of the highly inflammatory kind, assumes the catarrhal form, and is attended from the commencement by nervous and spasmodic symptoms, the treatment must undergo modification in proportion to the absence of febrile action. It is only in the earliest stage that bleeding, whether local or general, is admissible, and it may, I believe, well be dispensed with. Blisters and rubefacients to the upper part of the chest and the lower part of the neck are very serviceable in this form of croup; warm baths and the inhalation of aqueous vapours are also productive of great benefit. Mercury, combined with James's powder, should be given freely during the earlier periods, and antimonial emetics throughout all the stages. It is in the humid or catarrhal croup, where the exudation within the air passages is still albuminous, but not concrete, that emetics and nauseating remedies are most valuable; they may be relied on almost without the assistance of other means. As Dr. Cheyne observes, they are the true expectorants; they clear the air passages, determine to the skin, and change the character and increase the quantity of the bronchial secretions. The antispasmodic medicines mentioned in the last page are frequently needed towards the termination of the disease, and, together with external rubefacients, are the chief means in which we can confide.

I have not thought it necessary to enter into a detail of all the

¹ Treatise on the Croup, p. 72

medicines that at various times have been upheld by different authors as specifics in croup. An attentive and careful investigation of the symptoms and of the pathological effects of the disease, together with the energetic application of well known remedies, are far more likely to conduce to successful treatment than the indiscriminate use of medicines that are vaunted by their discoverers as infallible, and raised by unmerited praise to ephemeral reputation, only to sink into a deeper oblivion.

I have hitherto spoken only of the medical treatment of croup, but as there are cases on record in which tracheotomy has been successful, it becomes necessary to enquire under what circumstances this operation is justifiable, or likely to afford relief; at what period of the disease is its performance to be resorted to; what has been its usual success; and what are the objections that may be urged against its adoption.

Dr. Home,¹ the first historian of croup, proposed this operation as a last resource in the treatment of the disease, supposing that it would favour the expulsion of the false membranes, and thus prolong the life of children who were in danger of instant suffocation. Since the publication of his opinions they have been adopted by many authors, who have talked largely of the probable advantages of such an operation, without adducing any successful cases in support of their assertions. As a last resource in croup, when the stage of collapse has begun, and when the symptoms of suffocation are imminent, what relief can be expected from tracheotomy? At this period of the disease the lungs are generally loaded with blood, the vessels of the brain are gorged with an imperfectly oxygenated blood; and probably effusion of serum into the ventricles will have commenced; under these circumstances tracheotomy cannot cure; it cannot even be expected to afford temporary relief. Immediately after incising the trachea, a large quantity of mucus will probably be expelled through the wound, and the labour of respiration will, for a time, be diminished; this is the most favourable result that can be expected; and the occurrence of this degree of relief must depend upon the disease in the air tube not having extended below the larynx. If the inflammation and exudation of lymph exists throughout the trachea, or are continued into the bronchi, the patient will, in all probability, perish miserably under the hands of the operator; and, unfortunately, we cannot decide by the symptoms before death what is the exact situation and extent of the membranous effusion.

In the earlier stages, before lymph has been poured out, and when the mucous membrane is red and tumid, nothing but an aggravation of the inflammation can be expected from the operation in question; besides, we are not justified in having recourse to it, whilst so many other remedies are in our possession, unless it can be shown that the probability of success is very great.

¹ An Enquiry into the Nature, &c. of Croup, p. 59.

With regard to the general results of tracheotomy, when performed for the cure of croup, I have no hesitation in saying that they are so unfavourable as to warrant us in the strongest condemnation of it in almost every conceivable circumstance. Every author of character, to which I have been able to refer, agrees in declaring that it should never be attempted. Cheyne, Porter, Royer Collard, Bricheteau, Viensseux, Double, Albers, Jurine, are unanimous on this point. Nevertheless, as was before stated, the operation has been sometimes attended with success. An instance of this occurred to Burserius;¹ but the facts of the case are badly reported, nor is the period of the disease at which the operation was performed, at all indicated. Membranous concretions were expelled through the wound for two days subsequent to the operation, and the patient was cured in fifteen days after its performance. Bretonneau² also succeeded in one instance out of four, in which he made the attempt to cure croup by tracheotomy. The patient was a delicate girl, aged four years. She was actively treated by mercury, emetics, and blisters, but the disease increased, the cough became suffocating, the respiration extremely difficult, and membranous concretions were expectorated. On the seventh day from the commencement of the precursory symptoms, tracheotomy was performed, and five rings of the trachea, situated between the thyroid gland and the sternum, were, after great difficulty divided, and a canula placed in the wound.—The respiration immediately became calm, but great weakness was produced by the loss of blood that took place during the operation. Fragments of membranous concretions were expelled through the wound for seven days after the operation, and the canula was kept constantly in the wound for eight days, and occasionally afterwards. On the nineteenth day from the performance of the operation, the wound was cicatrised, the voice had recovered its tone, and only a slight cough remained, which in a short time entirely ceased. M. Trousseau³ has likewise performed this operation with success in the last stage of croup. In this case, (that of a boy, aged six and a half years), tracheotomy was practised on the third day. Immediate relief from the suffocative attacks was obtained; shreds of false membrane were expelled through the wound for three days succeeding the operation; but few bad symptoms occurred, and the recovery was complete in fifteen days, except that the wound took a little longer to cicatrise.

The time at which the second operation was performed, appears to have been about the termination of the second stage of the disease, when the false membranes had formed, but before collapse had commenced. The last operation was done at a later period of the disease, and its result is, therefore, the more surprising.

Considering with what avidity instances of successful operations

¹ Institut. Med. Pract. v. iii. p. 404.

² Traité de la Diphthérie, p. 300.

³ Journal des Connais. Med. Chir. Sept. 1833.

are made known to the public, these three cases may be almost viewed as exceptions which increase the stability of the general rule, that tracheotomy is not applicable to the cure of croup. The difficulty of performing the operation in children is of itself a most serious objection to it; the natural struggles of the patient, the constant motion of the larynx upwards and downwards, and the confusion caused by hemorrhage from the greatly distended thyroid veins, form an assemblage of most perplexing and embarrassing circumstances. Instances of the unsuccessful termination of tracheotomy, when employed for the cure of croup, may be found in Porter's *Pathology of the Larynx*; Bretonneau, *Traité de la Diphtherite*; Albers; Jurine; *Report sur le Croup*, par Royer Collard; Viesseux; and many others.

CHAPTER X.

DIPHTHE'RITE.

This name has been given, by Dr. Bretonneau, of Tours, to that species of croup which affects adults. It is a disease of much rarer occurrence than the one that has just been described, and possesses characters sufficiently distinctive to entitle it to a separate notice. At the same time, it is proper to state that Bretonneau considers that the ordinary croup of children, the cynanche maligna, and the plastic angina, or *angine couenneuse* of the French, are all precisely the same disease, but producing different effects according to the seat and the degree of the morbid action.

The diphthérite commences with pain in the throat, difficulty of swallowing, and general febrile symptoms; on inspecting the fauces, the tonsils are observed to be swelled and reddened, and to have upon their surface patches of a thick, opaque, whitish concretion, which at this period of the disease are easily detached from the mucous membrane. If allowed to go on unchecked, the inflammation and the membranous exudation spread by continuity to the adjacent parts, the soft palate and pharynx; the glands at the angles of the jaw begin to swell, and deglutition becomes more difficult. If the concretion be detached from the membrane beneath, the redness greatly augments in the denuded parts, and another and thicker concretion is soon poured out, which adheres to the mucous surface with more tenacity than before. It frequently happens, that some days after the commencement of the attack, the disease becomes milder in character, less disposed to spread, and even ceases altogether without reaching the air passages, in which case there is very little reason to be under any apprehension for the result. In most instances, however, at the end of four or

five days, laryngeal symptoms begin to display themselves, such as a hoarse cough, alteration of the sound of the voice, and dyspnœa. From this time the patient has every appearance of suffering from severe croup, with the addition of an almost complete inability to swallow; the breathing becomes quick, laborious, and sonorous, the voice is soon extinct, the countenance livid, and the pulse small and intermitting; paroxysms of suffocation take place, till in one more severe than the rest death closes the scene.

The duration of the disease varies considerably; in some instances it has caused death in the course of a few hours;¹ generally, however, the morbid action continues in the tonsils and soft palate from three to seven days before affecting the air passages; but after the larynx has shown signs of being attacked, from one to two days are usually sufficient to destroy life.

The diphthêrite occurs occasionally in a sporadic form, but much more frequently as an epidemic; it attacks individuals of all ages, from the most tender infancy to very advanced periods of life, but children of either sex, from the age of four or five to the time of puberty, seem more liable to it than other persons. In M. Bretonneau's opinion it is decidedly contagious, and especially when combined with scarlatina, which is one of its most frequent complications.² The epidemic and contagious nature of croup has been often asserted and as frequently denied; considering the similarity of the two complaints, is it not highly probable that they have been sometimes confounded one with another, and that those authors who have maintained that croup is epidemic and contagious have been drawing their inferences from observations made upon the diphthêrite? Mr. Runsey,³ for example, who seems not in the slightest degree to have doubted the epidemic character of the disease he met with at Chesham, and who, moreover, says that he had not been able positively to decide whether it was not sometimes infectious, several circumstances that he met with having rendered it probable, found, in the most of the cases which occurred in November and afterwards, inflammation of the tonsils, uvula, and velum pendulum palati; and frequently large films of a white substance were formed on the tonsils. In a note at the foot of page 37, he says, "Ulcerous sore throats, thought not very frequent, were now and then met with." From all which we may reasonably conclude that the disease was not, in every case, simple croup, but croup combined with a pellicular inflammation of the fauces, or diphthêrite. The cases narrated by Dr. Gregory in the 54th volume of the *London Medical and Physical Journal*, and by Mr. Sym, in the 55th volume of the same work, which are adduced as proofs that croup is contagious, appear, in most of the instances, to have been complicated with ulcerated sore throat and scarlatina. The

¹ Bretonneau, de la Diphthêrite, p. 55.

² Op. cit. p. 344.

³ Transactions of a Society for Medical and Chirurgical Knowledge, vol. i. ryl 8*

latter gentleman remarks, "From what I observed I concluded that the ulcerated sore throat, which appeared to be closely allied to scarlatina, constituted the contagious part of the disease, and that the croup was occasioned by an extension of the inflammation at the margins of the ulcers into the rima glottidis, and from thence along the mucous membrane of the trachea." He also says that an old man, an elder in the church, died of this complicated croup, after having spent a considerable time in an apartment in which an infant was dying of that disease.

The subject of contagion is at all times a difficult one, nor do I deem it proper to enter into any discussion on the contagion or non-contagion of croup; more facts and more accurate observations, made with the knowledge of there being a form of the disease different from simple croup, are yet wanting to enable us to come to a conclusion on this point.

The diphthérite, like the croup, prevails more in winter than in summer, though no particular causes are assigned for its origin, except contagion and the unknown causes of an epidemic.

Further to illustrate the course and termination of this disease, I shall introduce a fatal case, taken from M. Bretonneau's work on the subject, another from M. Louis's paper, "*Du Croup chez l'Adulte*,"¹ and one that occurred under my own observation.

CASE I.²

The patient, a strong boy, ten years old, began to experience some difficulty of swallowing on the 1st of January. On the 4th, the tonsils were greatly swollen, and, as well as the uvula, were covered with a grayish concretion; respiration frequent, and attended by a guttural sound; tumefaction of the cervical glands near the angle of the jaw. Pulse 94 to 96. Application of concentrated muriatic acid to the fauces, and a grain of calomel to be given every hour.

On the 5th and 6th the state of the patient continued the same, except that the swelling of the glands increased.

7th. Deglutition performed with greater ease; tonsils less swollen, but still covered with false membrane; tumefaction of the cervical glands remarkably diminished. The calomel was discontinued.

8th. Swelling of the glands again augmented; inspiration attended by a hissing noise; croupal cough. At eleven o'clock the dyspnœa increased, and death took place. Twenty minutes after death tracheotomy was performed, and artificial respiration had recourse to, but with no beneficial effect.

Dissection.—The lungs were healthy; the mucous membrane of the bronchi pale, that of the trachea, towards its middle part, partially reddened and covered with a tubular membranous concretion,

¹ *Recherches Anat. Pathologiques.*

² *LII. of M. Bretonneau, Traité de la Diphthérite.*

which was loose at its lower extremity, but became thicker and more adherent in the larynx, and less so again on the epiglottis. The marbled redness of the trachea was converted into a uniform deep-violet tint in those parts where the false membrane adhered most strongly to the surface beneath, and in no part of the air tube was the inflammation so intense as by the arytaenoid cartilages, where the pharynx communicates most directly with the larynx. The whole of the back of the fauces, the upper part of the pharynx, and the posterior orifice of the nostrils, were covered with membranous concretions, having a most intimate adherence to the parts on which they lay.

CASE II.¹

A woman, aged 72, had, when she was first seen, suffered for some days from sore throat, for which leeches had been applied. On the following day her countenance was flushed and anxious, respiration difficult, and accompanied by a hoarse sound; voice scarcely audible, deglutition impossible, pulse developed, and skin hot.

A few hours after, on examining the throat, a whitish false membrane was observed on the anterior part of the velum palati, and on this being raised, the mucous membrane beneath was bloody; the other symptoms were in no respect relieved.

On the following morning the patient was dying, the respiration shorter and more sonorous, and death occurred soon after the visit.

Dissection.—A very thick false membrane covered both surfaces of the velum palati, extended into the nasal fossæ, and penetrated into the larynx, trachea, and bronchi; it adhered more strongly to the larynx than to the trachea.

CASE III.

June 8th, 1836. James Overton, a delicate unhealthy child, aged five years, was brought to me at the Infirmary, covered with the eruption of measles, which the mother assured me had come out since she left home. I prescribed some diaphoretic medicine, and desired the mother to take the child home, keep him in the house, and to send for me if any unfavourable symptoms showed themselves. She sent on the morning of the 10th, but, on my arrival, I found the child so ill that there appeared to be no hope of his recovering. The measles still continued out, the bowels were relaxed, the breathing was accelerated, and attended with a mucous rattle; the countenance was anxious, the extremities cold, pulse small; there was also great difficulty of swallowing, a hoarse cough, and almost total suppression of the voice; restlessness extreme. I could not manage to see the back of the fauces, but there were

¹ IV. of M. Louis, (*Du Croup chez l'Adulte*), *Recherches Anat. Pathol.*

spots of membranous concretion on the roof of the mouth. The child died at four o'clock in the afternoon of the following day.

Dissection, thirty-nine hours after death.—The jugular veins were distended with fluid blood; the sub-maxillary glands were considerably enlarged. There was a thin, ash-coloured membranous exudation upon the uvula, upon that part of the pharynx which is contiguous to the larynx, upon the laryngeal surface of the epiglottis, and upon the lips of the glottis as far as the margins of the ventricles of the larynx. In the last mentioned situation, the false membrane adhered rather firmly; in the other places it was but loosely connected with the adjacent parts. The mucous membrane of the epiglottis was thickened and slightly injected, that of the lips of the glottis and ventricles was greatly reddened. The trachea exhibited but little traces of inflammation. The lungs collapsed imperfectly; they were in a state of sanguineous congestion, but not inflamed. The false membrane had not passed down the œsophagus, nor did the bowels exhibit any marks of disease.

About the time that this last case occurred, many children died of a similar affection of the throat, complicated with measles; but no examination was made of their bodies after death. They had, in most instances, cough, difficulty of swallowing, impeded respiration, hoarseness, ultimately suppression of the voice, and, in many cases, swelling of the sub-maxillary glands.

On the 28th of May I was called to Ann Chinn, aged three years, living in a court in a narrow street in Birmingham, and found her labouring under this affection of the throat, together with measles, which were imperfectly developed. She had also diarrhœa, which I may here remark, was a constant attendant upon the commencement of the diphtheritic disease. This patient died on the 29th, and on that day two other children, living in the same house, and one of them a sister of Chinn, broke out with measles. The eruption, which was at first vigorous, soon became pale and almost disappeared; the difficulty of swallowing was great, the respiration quick, but not sonorous; the cough soon became hoarse and the voice suppressed. Maria Chinn, aged eight months, was treated with antimonials and calomel; she died on the 4th of June. The other child, Ann Bird, aged eleven months, had leeches and a blister to the chest, and frequent doses of calomel and tartarized antimony; she died on the 9th of June. On the 11th of June, a female child, aged eighteen months, died of croup after small-pox: she lived next door but one to the Chinn family. No arguments that I could offer, would induce the parents of these children to suffer any of their bodies to be examined.

Cases of a similar nature occurred in the same district of the town; and within the last two weeks of the month of May, six other children died of the same affection. On Tuesday, the 31st of May, I visited William Allen, a stout boy, aged four years, who early in the morning of the Sunday previous, had been attacked by croup. Prompt measures were adopted by a neighbouring practitioner, and

the patient was much relieved, but not cured: the breathing was still sonorous, the voice very hoarse, and the cough croupal; there was also difficulty of swallowing, aphthous ulceration about the inside of the lips and tongue, and patches of lymph upon the soft palate. He took three grains of calomel and three of antimonial powder every third hour, to the extent of twenty doses. On the fourth day of my attendance, the measles broke out, and the patient was relieved by this circumstance, and on the 9th of June he was discharged cured, with the exception of a trifling cough.

On the 8th of June, I was called to Julia Bayliss, aged fourteen months, who, after a slight eruptive fever, broke out with the measles. She had neither cough nor dyspnœa; her bowels were relaxed, and she had extreme difficulty in swallowing any thing. An examination of the fauces showed the tonsils and velum palati covered with a thick ash-coloured membrane. A strong solution of alum was applied three times during the first day, and on the second no vestige of the false membrane remained, and the mucous surface was but slightly reddened in the situations where the membranous exudations had existed. This child took two grains of calomel every third hour for two days, and at the end of that time the bowels were regular, the powers of deglutition restored, and neither cough nor dyspnœa had supervened, so that probably the disease was checked at its onset.

On the 18th of the same month I was desired to see John Guest, a delicate boy, aged five years. He was very feverish; skin hot, face flushed, pulse quickened, and his voice had that peculiar sound that depends on enlargement of the tonsils. He had never shown any difficulty in swallowing till the morning on which I first saw him. On inspecting the fauces, the soft palate was found to be of a deep-red colour, and the tonsils and uvula were enlarged and covered by a false membrane; the sub-maxillary glands were painful and very much swelled; bowels confined.

A strong ammoniacal liniment was ordered to be applied outside the throat, and two grains of antimonial powder and one of calomel to be taken every third hour. On the following day the state of the patient was but little altered. On the third day the false membrane on the tonsils and uvula had not extended, but was become thicker and of a brown colour, and the breath had a most offensive odour. On the sixth day no trace of the false membrane remained, and the breath had lost its fetor; the boy's appetite had returned, and he appeared to swallow without much difficulty. A few doses of quinine and sulphuric acid soon restored him to health.

Overton's case appears to have been a genuine instance of the disease to which M. Bretonneau has assigned the name of diphthérite. There is every reason to believe that the inflammation and the membranous exudation commenced in the fauces and spread thence to the larynx, causing death by suffocation, as in idiopathic croup.

The two last cases, those of Julia Bayliss and John Guest, were examples of plastic angina, but it is highly probable that if the

mischief had not been arrested in the fauces, the inflammatory action and the deposition of lymph would have been propagated along the pharynx to the larynx, and that death would have ensued from the same cause as in the instance of Overton.

The other cases that occurred about the same time were probably of a similar kind, although their history is very imperfect, and their exact nature unascertained, owing to the impossibility of obtaining post mortem examinations. Taken together they show the existence of an epidemic affection of the mucous membrane of the fauces, which was inflammatory, and prone to terminate in the formation of membranous concretions. Almost all the cases were complicated with measles.

These cases are sufficient to illustrate the usual progress of the diphthérite; we observe in them the sore throat at the commencement, the redness and swelling of the tonsils and back of the mouth generally, the subsequent formation of a false membrane on the inflamed surfaces; and during this, which may be considered as the developed state of the plastic angina, and the initiative stage of croup, the symptoms that predominate are, difficulty in swallowing, and such a degree of dyspnœa as would be accounted for by the narrowing of the isthmus of the fauces and the partial occlusion of the posterior orifice of the nostrils. The developed croupal state, indicated by the suppression of the voice, the sonorous respiration, and the hoarse cough, is of very short duration, owing to the early affection of the larynx, which organ, being the gate of entrance into the air tube from the pharynx or fauces, is always found diseased in fatal cases, because the morbid action spreads by continuous surfaces only.

Pathology.—After death, the same morbid appearances are discovered in the larynx and trachea as have been pointed out as the ordinary effects of croup, with this striking exception, that the larynx is, in the diphthérite, always the subject of disease when the trachea is affected, because, as the inflammation and the albuminous exudation spread along continuous surfaces only, and as the disease, I believe, invariably commences in the fauces, the trachea can only be attained by the morbid action first passing along the membrane of the larynx. Besides the false membrane in the air passages, the posterior part of the nasal fossæ, the tonsils, velum palati, uvula, and pharynx, are generally covered with a similar exudation; to this, at least, there was but one exception in fifty-five subjects, of every age, that fell victims to the disease in question during the epidemic observed by M. Bretonneau at Tours. The membranous concretion, in a few instances, spreads along the nasal fossæ to the orifice of the nostrils; in two cases, M. Bretonneau found a false membrane lining the œsophagus as far as the cardiac extremity. In seven fatal cases of this disease narrated by M. Louis, under the name of "Croup chez l'Adulte,"¹ there was deposition of lymph on

¹ Recherches Anat. Pathologiques.

the nasal fossæ, uvula, palate, &c., and on the lining membrane of the larynx; in four only of them the same marks of disease were found in the trachea and bronchi. The exudation was always thinner in the trachea and larynx than on the fauces, and in proportion to the weakness and poverty of constitution of the individual attacked, was the false membrane found in greater quantity; in many instances, the albuminous concretions about the fauces assume a dark colour, and have a very offensive odour. These circumstances have induced many observers to believe that the parts in this neighbourhood were in a state of gangrene, and the disease, in consequence, has obtained the name of *cynanche maligna*; but the more accurate investigations of M. Bretonneau show that it is the membranous concretions only which become putrid, and that the mucous membrane of the fauces and pharynx remains beneath, quite unaffected by any thing like gangrene. The colour of the concretions is owing to the extravasation of blood, mixed with the effused lymph; and the early putridity may easily be accounted for by the warmth and moisture of the situation, and by the constant current of damp air which was passing over their surface.

The consistence and tenacity of the false membrane in this disease are much the same as in croup; it is always thicker in the pharynx and fauces than in the larynx and trachea, and its extent is necessarily more considerable than in croup. It is often found in one unbroken tube from the top of the pharynx to the primary divisions of the bronchi, and in other instances it ceases at various distances below the commencement of the trachea.

The state of the mucous membrane beneath the albuminous concretions differs in different subjects, but generally it exhibits more traces of inflammation in the pharynx and fauces than in the larynx and trachea, and the redness is patchy in the former situation. When the albuminous concretion is found adhering very strongly to the mucous membrane beneath, the latter is commonly very much injected, and spots of blood are found on the under surface of the concretion.

Nature of the Disease.—If we compare the symptoms and the pathological effects of the diphthérie with those observed in the ordinary forms of infantile croup, we are struck at once by the many points of analogy that exist between them, though there are some differences in their origin and progress. That the two diseases are similar in their nature can admit of no doubt; the latter periods of both affections are precisely the same, the organic lesions in the air tubes discovered after death are also exactly of the same character. The differences that exist between them are, 1st. That the diphthérie is contagious, whilst the croup, in all probability, is not; 2d. That the former affects individuals of all ages, whilst the latter confines its attacks to children before the time of puberty; 3d. The croup commences with catarrhal symptoms; the diphthérie, on the contrary, begins with pain, redness, and swelling of the tonsils and back of the throat generally, and great difficulty in swallowing,

which latter symptom is seldom present in any stage of croup: 4th. The diphthérite causes death very rapidly whenever the morbid action has reached the air passages, because the larynx is always affected; in Louis's cases the patients never lived longer than from eighteen to thirty-six hours after the moment when we might presume, from the alteration of the voice, that the false membrane had reached the larynx.

These points of dissimilarity are sufficient to show that the diphthérite and the croup are not exactly identical, though they are but different varieties of the same species. The points in which the diseases agree, and which prove them to be of the same nature, are, that the character of the inflammation in both is the same, they both end in the effusion of albuminous concretions; and the parts ultimately affected are the same in both.

The diphthérite may confine its action to the fauces and pharynx, and, at the end of an indefinite time may either spontaneously disappear, or cede to the local or general application of remedies; in this case it resembles croup only in as much as it is an inflammation of a mucous surface attended by the formation of a false membrane. The character of the inflammation in croup is, though commonly sub-acute, more sthenic than in the disease now under consideration. The pellicular disease of the fauces, when epidemic, more frequently attacks weak and debilitated subjects than those in robust health, and its effects in subjects of the former class are much more severe than in others.

Treatment.—Diphthérite is, at its commencement, so much a local disease that the constitutional symptoms might almost pass unnoticed, and it is only when the respiration becomes disturbed, that the general health sympathises to any extent with the local affection. I have before stated that this disease only becomes dangerous by spreading from the fauces to the air tubes, from which we may see how exceedingly important it is that curative measures should be adopted at the earliest period, and that they should be directed with energy to the suppression of the morbid action in the fauces, as when once the larynx is affected, all expectation of a cure is destroyed.

M. Bretonneau places more reliance on local applications of a stimulating nature, applied to the diseased part itself, than to any plan of general treatment. The antiphlogistic measures which are so beneficial in early stages of croup, are here, to say the least of them, inefficacious; and the abstraction of blood, instead of being useful, has generally served to accelerate the propagation of the diphthéritic inflammation. In confirmation of this it may be stated, that this disease is always more severe and more certainly fatal in those subjects whose powers have been already depressed by antecedent diseases. In such individuals the membranous exudations are large in quantity, and spread to the surrounding organs with remarkable activity.

The only constitutional remedy not quite destitute of efficacy is

mercury; and this has occasionally cured the disease, even when it had reached the larynx. In one remarkable case, mentioned by Bretonneau in page 8 of the appendix to his work, the patient was moribund when the mercurial treatment was commenced, the head was thrown back, the respiration was attended with a hissing noise, and suffocation was imminent. Calomel was given, and by the third day the expectoration had become mucous, and the patient soon recovered. Many other cases of the success of the mercurial treatment are related, and likewise many failures. The only instance recorded by M. Louis in which a cure was obtained, was the only one in which mercury was tried, and in this individual croupal symptoms, such as alteration of the voice, pain in the larynx and trachea, and suffocative attacks, presented themselves, but were eventually relieved.

The topical applications on which reliance is chiefly to be placed are, muriatic acid, nitrate of silver, and alum; and their mode of action seems to be the exciting of such a degree of common inflammation as shall supersede and set aside the special inflammation under which the patient is labouring. The safest of these, and the one which has effected the greatest number of cures, is alum; it may be reduced to a paste by admixture with water or honey, and it should then be applied to the inflamed surfaces by means of a small brush or the handle of a tea-spoon. Its effect is to detach the false membranes, and to repress the exuberance of the swelled and inflamed mucous surface. One application is seldom sufficient; it should be applied frequently till the albuminous exudations cease to present themselves, and till the parts are reduced to their natural colour and volume. The muriatic acid and the nitrate of silver are more uncertain in their results; they must be applied with extreme care, and in such a manner as only to come in contact with the inflamed organs. With the majority of patients, who are children, this is, of course, extremely difficult to effect; and the existence of this difficulty is another strong ground for using the alum, which is innoxious if swallowed, and does not inflict any injury on surrounding parts.

If neither topical nor general remedial measures have been had recourse to before the disease is propagated to the larynx, the only hope of curing the patient rests upon the performance of tracheotomy; the value of this operation in the ordinary form of croup I have already endeavoured to estimate, and with respect to the probability of its proving advantageous in the diphthêritic form, nearly all the objections that were before urged against it apply here with equal justice. There is one solitary circumstance that renders the operation more feasible in the disease under consideration than in genuine croup; that is, we may be always sure that the larynx is the part of the air tube primarily attacked, and that, if tracheotomy be performed on the first appearance of croupal symptoms, the larynx is the only part of the air tube affected. This is very

important, because it accurately points out the moment at which the operation should be done, and, from the rapid manner in which the inflammation extends itself along the continuous mucous surfaces of the larynx, trachea, and bronchi, the only moment when any reasonable chance of success from its performance exists. At the same time, we have no reason to believe that the simple fact of incising the trachea will put a stop to the extension of the disease into the lower parts of this organ; and on this account other difficulties and doubts occur than are present in simple croup, where we have no grounds for supposing that the inflammation has so rapid a power of propagating itself. The operation cannot be performed with so much facility in diphthéríte even as it can in croup, on account of the enlargement of the absorbent glands and the greater degree of external swelling of the neck. From all these considerations it appears that tracheotomy is scarcely justifiable, that its accomplishment is attended with great difficulty, and its efficacy involved in great doubt.

FUNCTIONAL DISEASES.

CHAPTER XI.

SPASM OF THE GLOTTIS.

The term spasm of the glottis is used to designate a train of symptoms which are unquestionably caused by a morbid approximation of the sides of the rima glottidis, but which are, at the same time, quite independent of any structural alteration in the larynx, or of any diseased condition of the secretions of this organ. I have employed the words as a title to the present chapter because they have been long and generally used by the profession to express the occurrence of certain functional derangements in the action of the laryngeal muscles, although the recent investigations of Dr. Ley and others render it highly probable that these disordered actions are not always, at least, of a spasmodic nature.

I have before had occasion to remark upon the frequency with which the inflammatory diseases of the larynx are accompanied by a spasmodic closure of the glottis, and upon the increased distress

and danger to the patient that results from this circumstance; I shall here confine my attention to that class of cases in which the symptoms of spasm of the glottis exist uncombined with any of the signs of inflammation in the vocal organ. The disease admits readily of two sub-divisions, 1st. The spasm of the glottis of infants—the *Laryngismus stridulus* of Dr. Mason Good—and 2d. Spasm of the glottis from the pressure of tumours upon the larynx or trachea, or upon the nerves which are distributed to them; the latter form of this affection may occur at any age, but is more frequently observed in adults than in children.

I.—LARYNGISMUS STRIDULUS, OR CROUP-LIKE INSPIRATION OF CHILDREN.

The attention of the profession was first particularly called to this disease by Dr. John Clarke,¹ who described it as “a peculiar species of convulsion, but, under the names of Millar’s asthma, spurious croup, and spasmodic constriction of the chest and larynx, it had frequently been noticed, both in this country and on the continent, previously to the publication of Dr. Clarke’s work. Its essential and characteristic symptoms are, paroxysms of difficulty of breathing, which come on suddenly, and are terminated either by suffocation, or by a deep crowing inspiration; during the paroxysm the voice is stridulous, the countenance flushed, swollen, and indicative of great distress: the usual signs of fever are absent.

Children, who are alone the subjects of this disease, are generally attacked for the first time during the night, and without any previous warning. The little patient wakes suddenly from his sleep “with a spasmodic inspiration, consisting of frequent attempts to fill the chest, between each of which a squeaking noise is often made;” the first paroxysms are, in most instances, transitory, and, after the lapse of a few seconds, he regains the power of breathing freely, and soon cries himself to sleep. The attack may return after various intervals; at the commencement of the malady, the patient often remains many days, or even weeks, without the suffocative paroxysms being renewed; but if the pathological condition which first caused them persists, they will return, as the disease makes progress, “with such alarming frequency, that the child is scarcely free from one attack before another begins.”² In the early stages, the attacks commonly take place during the night and in the midst of the most tranquil sleep; occasionally they are induced by suddenly and rudely waking the patient; but as the disease advances, they occur in the day also, and are brought on by the most trivial circumstances, such as a temporary interruption of the sports, surprise or fright. The paroxysms increase in severity and in duration, as well as in frequency. At first the respiration is rendered

¹ Commentaries on some of the most important Diseases of Children, c. iv.

² Dr. Ley, on the *Laryngismus Stridulus*, p. 2.

difficult, is attended by a mucous rattle in the trachea, and the fit terminates after a short time with a deep, sonorous inspiration; but, in the progress of the disease, the symptoms become aggravated in a great degree: "each inspiration is attended by a loud crouping noise, which may be heard in an adjoining apartment; the chest and larynx appear to be painfully constricted."—"So great is the difficulty of breathing, that it sometimes appears to be almost totally suspended for a few seconds. The countenance is then, usually, pale, as in a state of syncope: sometimes, but more rarely, it is dark, and the vessels of the face turgid, as in apoplexy. The child has frequently attacks of convulsions, during which the features are much distorted."¹ With respect to the duration of the paroxysm, at first it seldom continues more than one or two minutes, but afterwards it becomes lengthened, sometimes to the extent of a quarter of an hour, or more.

This increase of the frequency, severity, and duration of the suffocative accesses, is not an unvarying consequence of the persistence of the disease; occasionally the attacks decrease in violence, and then become suddenly aggravated again. When these remissions and exacerbations occur, "the latter may commonly be traced to painful dentition, the symptoms recurring as each successive tooth advances, and gradually declining or disappearing after it has penetrated the gum."²

The general health of children who become the subjects of this disease is usually bad in the first instance, but occasionally those in an apparently perfect state of health are attacked by it,³ and seem to suffer but little in the intervals between the paroxysms whilst the malady is in its early stages. The appetite remains good, the countenance lively and animated, and the sleep sound and refreshing. Ultimately, however, this happy state of things passes away; the child becomes restless and dispirited, the countenance anxious, the "brow is constantly knitted,"⁴ and his slumbers are generally terminated, in a sudden manner, by the occurrence of a paroxysm of interrupted respiration.

The affection of the glottis is, on its first occurrence, totally uncomplicated with any other disease, and is frequently cured without its involving the derangement of the functions of any of the other organs of the body; but if mismanaged or neglected, or if the treatment employed is powerless in arresting the progress of the disease, the muscles of the hands and feet assume a spastic rigidity. The thumbs will be found pressed constantly and firmly against the palms of the hands, the toes will be bent downwards, and the wrist and ankle joints inclined inwards, producing that condition of the extremities to which the name of "carpo-pedal contractions" has

¹ North on the Convulsions of Infants, p. 257.

² Ley, *op. cit.* p. 3.

³ Marsh, Dublin Hospital Reports, vol. v., p. 618.

⁴ North, *op. cit.* p. 258.

been given. If the course of the disease still remains unchecked, these signs of cerebral irritation will, in all probability, be succeeded by an attack of severe and universal convulsions.¹ The contractions of the hands and feet, and the ultimate occurrence of convulsions, are such frequent attendants upon the continued progress of the laryngeal affection that they have been considered, by some distinguished writers on this disease, as forming an essential part of it. Dr. Ley combats this idea: "I have seen," he observes,² "this disease go on from its commencement to its fatal termination without this sign, which I believe to be purely accidental, and not to be found even in a simple majority of cases." Dr. Clarke, Mr. North, and Dr. Marsh, appear to think the disease is of a spasmodic nature, and that, if protracted, it will always be complicated with general convulsions, though, at the same time, they speak of cases which ended fatally without any organ, except the glottis, being implicated. The attendant convulsions are sometimes of the severest kind, amounting to complete and long continued opisthotonos.³

Causes.—Amongst the causes of this disease have been enumerated scrofula, cachexia produced by defective nourishment and an impure atmosphere, head affection, cutaneous diseases of the scalp, dentition, disordered bowels, and some others of minor importance and of doubtful character. Almost every writer upon this disease mentions scrofula as the most active predisposing cause; Dr. Marsh remarks that all the cases which he had witnessed occurred in children either themselves exhibiting marks of the strumous diathesis, or sprung from scrofulous parents. Scrofula being a constitutional disease, and generally prevailing in most of the members of a family when one is affected with it, we can easily account for the frequency with which the malady under consideration has been found to attack two or three individuals in the same family. An impoverished condition of the system, from the combined agency of bad nourishment and an unhealthy atmosphere, is another cause upon which much stress has been laid, and its effect in predisposing to this disease probably results from the same circumstances as in the instance of scrofula. Children thus constituted are well known to be more liable to nervous and spasmodic diseases than those of a more robust make, and we find in the affection now under consideration that these subjects suffer soonest from the occurrence of general convulsions.

Inflammatory action in the brain or its membranes has been considered as the most frequent cause of spasm of the glottis; Dr. Clarke and those authors who believe in the purely spasmodic nature of the disease are of opinion that the affection of the larynx is always dependent on cerebral disease, or at least on a disordered state of the functions of the brain. To this subject, however, I

¹ Marsh, op. cit. p. 600.

² Op. cit. p. 12.

³ North, p. 258. Marsh, op cit., p. 609.

shall return when considering the pathology of laryngismus stridulus. Dr. Ley¹ allows that "vascular excitement within the cranium may occasionally produce the crowing inspiration; but the weight of testimony is decidedly averse to the conclusion that such relation is frequent, or that it is direct." When the attacks of laryngeal spasm precede for some time the occurrence of any signs indicative of head affection, it is mere assumption to affirm that the latter is the cause of the former; but when the reverse takes place there is some reason for the assertion. In the following case, for example, which occurred within my own observation, we may safely attribute the spasm of the glottis to disease within the cranium.

The patient, a boy, aged three years, had been much reduced by long continued diarrhœa, when he was attacked with symptoms of meningeal inflammation—pain in the head, delirium, and quick pulse. Leeches were applied to the temples, and cold applications to the head generally, and on the following day he was much relieved. On the third day there were symptoms of effusion within the cranium, such as drowsiness, slow pulse, and vomiting, succeeded by general convulsions. 5th day. Great restlessness, constant but unavailing attempts to vomit, inability to swallow, every thing returning through the nostrils. The respiration is quickened, and during inspiration the larynx is much drawn down, and a croupy noise always accompanies the act. No cough, voice natural, countenance very anxious. The patient fell into a state of coma, and died during the night.

Dissection.—There were no morbid appearances about the fauces, pharynx, or larynx. The sinuses of the head and the meningeal veins were greatly distended, the convolutions of the brain were flattened, and the external membranes rather dry. All the ventricles were distended to their utmost by a clear fluid; septum lucidum very soft, almost creamy; the fourth ventricle was immensely dilated, more so than ever I saw it before. The other organs of the body were free from disease, except the lungs, which contained a large number of miliary tubercles.

In this instance, the patient had never before been affected with croupy inspiration, and as the affection of the head preceded that of the larynx four days, we can have no reason to doubt that the connection between them was one of cause and effect. It is to be remarked, also, that the croupy inspiration appeared soon after the symptoms of cerebral compression, and that it was accompanied by a paralysed condition of the pharyngeal muscles.

The other cause of laryngismus stridulus which have been enumerated are dentition and disordered bowels. These must be considered in the light of exciting causes, and as not of themselves

¹ Op. cit. p. 75.

sufficient to bring on the peculiar symptoms of this disease; for the frequency with which the functions of the brain and nervous system are disordered, during their continuance, without the production of laryngeal spasm, is so great that there is evidently some other agency necessary to direct the morbid action to the muscles of the glottis. As exciting causes, however, they deserve particular attention, since in by far the majority of instances of this disease, the occurrence of the paroxysms, or, in the opinion of every author, their exacerbation, may be traced either to difficult dentition or to the existence of a disordered state of the digestive organs. Low and damp situations, a long continued wet season, and much exposure to cold and damp, have been mentioned by authors both as predisposing and exciting causes of this disease.

I have before stated that this affection of the glottis is peculiar to children, but the age at which they are liable to be attacked by it has been differently stated by different authors. Dr. Hamilton says it is peculiar to the period of cutting the deciduous teeth; Dr. Clarke also remarks that it seldom occurs after the third year; Mr. North says that the premonitory symptoms generally occur between the third and seventh month, and that the disease subsides with the appearance of teeth; whilst M. Capuron affirms that it is most frequently observed from the age of two years to that of seven. All authors, however, agree that the disease never occurs after the twelfth year. The reason of this is, probably, to be sought in the decreased liability to convulsive and glandular complaints after that period of life, and in the enlargement that takes place in the aperture of the glottis just about, and previous to, the attainment of puberty.

Diagnosis.—This disease has received the name of spurious croup and cerebral croup, but it differs entirely from croup in its nature. It is not attended by any inflammatory symptoms during life, and after death it leaves no traces in the larynx or trachea of its previous existence; it has no precursive signs, but comes on with a degree of suddenness that is of itself sufficient to distinguish it from croup. The extraordinary intermissions that occur, the absence of cough, of indications of pain and general fever, are other signs which render the diagnosis sufficiently sure. From suffocative catarrh it may be known by the absence of wheezing, and by the existence of a stridulous alteration of the voice.

Nature of the Disease, and Pathology.—The consideration of the nature of laryngismus stridulus is completely involved in that of its pathology, for although I have not hesitated to place it amongst the functional diseases of the larynx, there can be no doubt that the disordered action of the muscles of the glottis results from some organic lesion either in the muscles themselves, in the nerves which actuate them, or in the brain.

The impeded respiration and the crowing inspiration are unquestionably caused by a contracted state of the aperture of the glottis. The nature of the sound, with which we are familiarised in the

ulcerative and inflammatory diseases of the vocal organ, is quite distinct from that occasioned by thickening of the lining membrane of the larynx or trachea; it depends on a temporary cause, since, though death may have taken place with every symptom of strangulation in instances of this disease, we find no obstruction in the air passages after death that will account for the previous suspension of the respiration. The distress in breathing being entirely confined to a difficulty of filling the chest with air, the drawing down of the larynx during the attempt at inspiration, and the crowing noise that accompanies the partial success of the attempt, point out the larynx as the organ where the obstruction exists; whilst the absence of organic changes in the larynx after death is a convincing proof that the impediment to respiration must have had for its cause an approximation of the sides of the glottis from disordered action of the laryngeal muscles.

Having thus determined the seat of the disease and the proximate cause of its symptoms, we have next to inquire into the nature of the functional derangement of the muscles of the glottis. Muscles are subject to two lesions of function, viz., excessive action, which may either be convulsive or spasmodic, and defective action, or paralysis. Excessive action in the muscles which close the glottis might produce all the symptoms of laryngismus stridulus, and paralysis of the dilating muscles, by leaving the power of their antagonists uncontrolled, might occasion the occurrence of similar phenomena. Previously to the publication of Dr. Ley's elaborate work on this disease, no doubt was entertained as to its spasmodic nature, and in the opinion of most of the authors who treated upon the subject, the spasm of the muscles of the glottis was owing to the existence of cerebral disease of an inflammatory character. The fallacy of the latter opinion as a general rule has been shown by the results of post-mortem examinations, in which, when the affection of the glottis has occasioned death at an early stage of its existence, no trace of disease has been discovered in the brain or its membranes; nor, in the generality of cases, are there any signs indicative of cerebral mischief present before death, till many attacks of the croupy inspiration have occurred. The distended state of the meningeal veins, and the presence of serous effusion under the arachnoid and within the ventricles of the brain, which are the lesions usually found when the disease has been of long continuance, are easily accounted for by the previously impeded state of the respiration, and the consequent disturbance of the circulation. This state of the parts within the cranium has frequently been observed, when death has been occasioned by a long continued obstacle to freedom of respiration from chronic laryngitis or œdema of the glottis. Although it would probably be difficult for those authors who believe in the universal dependence of this disease upon an affection of the brain, to show in what manner a turgid state of the vessels of the brain, or an effusion of serum within its cavities, could produce a spasmodic closure of the glottis, yet as no

morbid lesions are discoverable in the larynx or trachea after death, and as their firm belief is in the spasmodic nature of the disease, they naturally ascribed the effects they witnessed before dissolution took place, to the only organic lesion they can discover on a post mortem inspection. Mr. Pretty has assigned to this disease the name of *cerebral croup*, from a belief in its connection with a morbid condition of the brain; three of his own children were affected with it, and one died, and "upon dissection, the blood vessels of the brain were found unusually loaded, and effusion had taken place into the ventricles and between the pia mater and arachnoid."¹ Another recovered after his nurse had been changed and he had been sent into the country. Dr. Marsh records the dissection of a child, aged nineteen months, who died of "spasm of the glottis," and who, up to the moment of the fatal paroxysm, had been in good spirits and apparently good health, though subject to slighter attacks of the same kind for some time previously.² "On removing the skull-cap a large quantity of dark fluid blood escaped; there was great turgescence of the vessels of the membranes of the brain. The brain was healthy; on removing it a considerable quantity of blood escaped from the spinal canal." The rima glottidis was found very much contracted, but on examining the larynx on the following day the rima glottidis was found to have recovered its natural dimensions. Dr. Marsh adds, "It is clear in this case that the spasmodic closure of the rima glottidis was the immediate cause of death; the turgid state of the vessels of the brain and lungs, as well as the gorged state of the heart, were evidently the effects of the suffocative struggle, and resulted altogether from the manner in which death took place. The symptoms at the commencement are thus proved to be purely spasmodic, and it is only when the disease increases in severity, and when general convulsions arise, that the brain or its membranes become the seat of disease." The last remark is true almost without exception; it is corroborated by an observation of Mr. North that, "in a great majority of instances, we have no proof of affection of the head."³ In the only fatal case of this disease which occurred in the practice of the latter gentleman, the vascular system of the brain, after death, "presented a highly turgid appearance; a small quantity of blood was effused under the dura mater in several parts; the ventricles contained a small quantity of fluid; the whole cerebral mass was particularly firm; the cerebellum was softer than usual at so short a period after death."⁴ During the life of this child no symptom of determination of blood to the head had been observed; and, in Mr. North's opinion, death took place from a sudden rush of blood to the head, differing but little from an attack of sanguineous apoplexy in an adult.

¹ London Medical and Physical Journal, vol. lv. p. 11.

² Dublin Hospital Reports, vol. v. p. 615.

³ On the Convulsions of Infants, p. 262.

⁴ Ibid. p. 264.

The universal dependence of laryngismus stridulus upon inflammatory disease within the cranium is, therefore, quite at variance with facts; the turgidity of the cerebral vessels and the serous effusion within the ventricles, when coincident with symptoms of laryngeal spasm, are generally to be viewed in the light of effects rather than causes; the same state of the parts within the cranial cavity is continually found, unconnected with symptoms of obstructed respiration. Are we, therefore, justified in disbelieving, with Dr. Ley, "the direct operation of cerebral pressure, excitement, inflammation, or effusion, in producing this peculiar convulsion of infant children?" The case related at page 130 seems to prove the contrary, and in this instance it should be remarked that the croupy inspiration did not occur as a symptom of cerebral excitement, but came on in the latter stages of the disease only, and after the appearance of signs denoting the existence of compression. The spastic rigidity of the thumbs, the drawing inwards of the hands and feet, and the occurrence of general convulsions, which are so often present in the latter stages of this disease, are confidently referred to by the believers in the cerebral origin of laryngismus stridulus as proofs of the truth of their doctrine. That these are signs of irritation of the brain is undoubted, but that the croupy inspiration results from the same cause is not therefore proved. For, in the first place, the affection of the glottis and the carpo-pedal contractions occur so often separately and quite independently of each other, that it is not unfair to presume they arise from a different source. In the second place, when these two affections are coincident, it will almost invariably be found that the derangement of the functions of the larynx has preceded for some time that of the muscles of the thumb and hand; and when the contrary happens, the laryngeal affection occurs simultaneously with convulsive movements of the general muscular system, or together with symptoms of compression of the brain and universal prostration, or paralysis. Examples of the latter state of things are exceedingly rare, and may probably be always explained by local mischief in the nerves which actuate the larynx. And, in the third place, the carpo-pedal contractions can generally be traced to difficult dentition, worms, or disordered digestive organs, and on the removal of these sources of irritation the extremities regain their natural state; whilst the paroxysms of croupy inspiration, though they may frequently be traced, apparently, to similar sources of irritation, and though the removal of these various irritations may cause an abatement of the laryngeal affection, yet they again return, and become more frequent and more severe in proportion to the lapse of time: whence we should infer the existence of an organic lesion, the operation of which was liable to be affected by other circumstances, as painful dentition, &c.

It is evident, from these considerations, that the disordered action of the muscles of the glottis and the carpo-pedal contractions arise generally, and probably always, from different causes; and the pathological observations that have been made upon the laryngis-

mus plainly show that its effects can seldom be referred to head affection.

Irritation or inflammation of the nerves that supply the muscles of the larynx may cause their undue action, and if the superior laryngeal nerve becomes the subject of inflammatory disease, we may expect a spasmodic closure of the glottis as one of the consequences. The idea that this affection of the glottis might be owing to disease in the pneumogastric nerve occurred to Dr. Marsh, who, after asserting the "purely spasmodic" nature of the symptoms, remarks, "It would be interesting, on any future occasion, to examine accurately the state of the pneumogastric nerve. The seat of the disease may perhaps be found to exist at the origin of this nerve." In confirmation of these views he refers to a case by Dr. Monro,¹ in which a child affected with hydrocephalus had violent cough and croup-like inspiration during the whole course of the disease, and after death, besides the signs of acute meningeal inflammation, the origins of the fifth and eighth pairs of nerves were of a deep-scarlet colour and covered with turgid vessels, and the eighth pair of nerves was of a deep uniform red along its whole track, as far as its branches going to the lungs.

Spasm of the glottis is certainly not a usual effect of inflammation of the eighth part of nerves, and since, when the whole tract of the nerve is inflamed, the muscles that expand the rima would be acted upon equally with those that close this aperture, it is probable some other cause of this peculiar affection of the respiration existed in the case cited by Dr. Marsh. The suggestion of this gentleman, to examine accurately the state of the pneumogastric nerve, is very valuable, and should be acted upon to enable us to decide more clearly upon the nature of the disease in question; at present we can only say that inflammations of important nerves are by no means common, whilst the laryngismus is of frequent occurrence; that if an inflammatory state of the nerve existed we should expect a more continuous effect than the production of a functional disorder, which is paroxysmal and renewed, oftentimes, after very long intervals.

Having examined the usual sources of excessive action in muscles, without being able to discover a satisfactory explanation of the phenomena of this peculiar affection of the glottis, it will be proper to ascertain, in the next place, if its effects can be traced to a contrary state of things, viz., a paralysis more or less complete of those muscles which expand the rima, and which, it will be recollected, are supplied exclusively by the recurrent branch of the eighth pair of nerves. I shall not recur to the subject of head affection as a cause of this disease, though the advocates for such an opinion might find more arguments in favour of its producing a paralytic state of some of the motor nerves of the larynx, in the advanced stages of the malady more especially, than for its exciting unusual muscular action.

¹ On the Morbid Anatomy of the Brain, p. 17.

The effects of a division of the recurrent nerves in animals have been so clearly shown in the experiments of Le Gallois and Brachet, with which medical men are thoroughly familiar, that I shall merely allude to them previously to entering on the subject of the paralysis of these nerves in man. Animals in whom the recurrenents have been divided lose their voice, are unable to expand the rima glottidis, and, as the result of this inability, die suffocated after the lapse of a certain length of time, which differs according to the nature of the animal experimented on, and according to its age. Very young animals perish much sooner from the effects of this operation than older ones, probably from the existence of a similar disproportion in them, between the size of the rima and that of the animal, to that which exists in the human subject at different ages.

Having thus mentioned the effects which usually result from a division of the recurrent nerves, and the consequent paralysis of the muscles that derive their motive power from this source, I shall proceed to unfold, in as precise a manner as possible, the peculiar views of Dr. Ley as to the pathology of laryngismus stridulus, referring those who wish for further information to his elaborate and highly valuable work on this subject. His opinions are based on pathological observations, and supported by many analogical deductions.

The hypothesis is simply this, that the symptoms of laryngismus stridulus are caused by impaired energy, or by complete paralysis of the muscles which open the glottis, in consequence of the pressure of enlarged glands upon the recurrent nerves during some part of their course; whence it results that the closing muscles of the glottis are unopposed in their action, and when, owing to the excitement of rage, fear, or great bodily exertion, the rima becomes for a time firmly closed, the weakened or paralysed dilators of the glottis are unable again to expand the aperture, and a paroxysm of the croup-like inspiration is produced.

The glands, to the enlargement of which Dr. Ley ascribes the crowing respiration, are those "which are constantly found at the root of the lungs, both before and behind the bifurcation of the trachea into the two bronchia, and frequently blend with others which lie upon the arch of the aorta, and not unfrequently between the carotids;"¹ and the deep seated chain of cervical glands known by the appellation of the *glandulæ concatenatæ*. "The former may be enlarged from exposure to cold, from frequent catarrhs, from disease of the lungs, pericardium, or heart, from a strumous taint; and probably from an extension of diseased action from the contiguous cervical glands, which according to Haller and others, constitute a continuous chain with them."² "The latter frequently enlarge and inflame from scrofula alone, but they may be enlarged also, not only from particular affections of the mouth, and of the

¹ Cruikshank, on the Absorbents, p. 129.

² Ley, on the Laryngismus Stridulus, p. 19.

integuments on the outside of the head, but from affections of the brain and its coverings."¹ The bronchial glands, when enlarged from any cause, may press upon the recurrent nerve soon after it has been given off from the par vagum; and the glandulæ concatenatæ, being in close proximity to the same nerve where it lies between the trachea and œsophagus, if much swelled, will exercise pressure upon the recurrent in this part of its course.

That glands enlarged by inflammation, or by any other cause, may materially impair the functions of nerves in their vicinity, is proved by the temporary paralysis of one side of the face that so often occurs in consequence of inflammation of the absorbent gland situated between the mastoid process and the angle of the jaw, and the consequent pressure that is made upon the portio dura. Dr. Ley quotes cases of this kind from Sir Charles Bell's work on the Nervous System; they are, however, of very common occurrence, and the agency of the inflamed gland in producing the paralysis has, I believe, never been disputed. In proof of the existence of enlarged bronchial and cervical glands in those children who are the subjects of laryngismus stridulus, Dr. Ley adduces some examples which terminated fatally, and in which, after death, these glands were found tumefied and pressing on the recurrent nerves; and others in which, though recovery ultimately took place, the deep-seated cervical glands could be felt larger and harder than natural, and in which the diminution in size of the glands was attended by an abatement of the suffocative attacks and the croup-like respiration.

"A consideration of the remote causes also tends to confirm this view of the nature of the malady. These are such as are likely to produce enlargement of the cervical or thoracic absorbent glands, or of both; we have seen that, in a large numerical majority of instances—according to my experience, in at least nineteen cases out of twenty—such enlargement has been actually traced; and where such cases have been examined after death, these glands have been found either surrounding the recurrent in its course, or compressing it upon the surface, or both."² The probability that Dr. Ley's views of the pathology of laryngismus stridulus are correct, is increased by the fact that almost every recent writer upon this disease has mentioned the existence of scrofula, or an hereditary scrofulous predisposition in the children who have become the subjects of it. In such individuals some of the usual exciting causes of the disease, as cold, eruptive affections of the scalp, and difficult dentition, notoriously occasion the enlargement of the cervical glands, and even affections of the brain and its coverings are cited by Cruikshank as causes of tumefaction of the same chain of glands; so that, perhaps, even those cases of spasm of the glottis in which head affection preceded the attacks of crowing inspiration might, if the

¹ Ley, p. 30. Cruikshank, p. 131.

² Ley, p. 126.

post mortem investigation had been pushed far enough, have resolved themselves into cases of paralysis of the dilating muscles of the glottis from glandular tumefaction.

The objections to Dr. Ley's theory have been ably stated by Dr. Marshall Hall,¹ and they are in substance the following: 1st. That pressure on the recurrent nerve would produce simple and continued paralysis, and would probably produce its effects gradually, whereas this disease comes on suddenly and recedes suddenly, to return at intervals of days, weeks, or even months; 2d. The affection of the glottis often accompanies other affections indisputably spasmodic, as strabismus, carpo-pedal contractions, and general convulsions; 3d. If the disease arose from the pressure of enlarged glands it would be less curable, less variable, and less suddenly fatal. Almost all the recent cases are at once relieved by attention to the commonly received causes of the disease, as the state of the teeth, the stomach and bowels, or by tonics and change of air.

The first objection, that on the score of the paroxysmal character of the disease, may be, in some measure, answered by a reference to the cases of paralysis of the face from the pressure of an enlarged gland upon the portio dura; the position of the mouth under ordinary circumstances remains natural, but on the patient being excited, laughing, or attempting to speak, the distortion of the mouth and face, from the paralytic condition of the muscles on one side, becomes very evident. The same thing, probably, happens with respect to the glottis, the ordinary state of which aperture is one of a sufficient degree of size for the performance of its accustomed functions; but when the respiration is hurried by bodily exertion, by fright, or by anger, the closing muscles of the glottis are excited to unusual action, and, being quite uncontrolled by their opponents, they contract or completely shut the rima, and a fit of crowing respiration is the consequence. Again, though the enlarged glands constitute a permanent disease, they may not always exercise pressure upon the recurrent nerve to a sufficient extent to produce its paralysis; but the adoption of some particular position, or the contraction of the muscles of the neck, may suddenly cause a degree of pressure upon the recurrent nerve great enough to deprive it of all its power. In conclusion, I may add that the paroxysmal nature of the malady, and its intermissions for days, weeks, and even months, form quite as strong arguments against its dependence on cerebral disease as against its glandular origin.

The second objection, that this affection of the larynx often accompanies other affections indisputably spasmodic—as strabismus, carpo-pedal contractions, and general convulsions—has been much discussed in a former part of this chapter. It has yet to be proved that strabismus and carpo pedal contractions are spasmodic, and general convulsions scarcely ever occur till the affection of the glottis has lasted some time, and till its attacks have become very severe;

¹ Lectures on the Nervous System, p. 76.

and then we have every reason to believe that the cerebral mischief which causes the convulsions is secondary, and has arisen from the reiterated accesses of obstructed respiration.

The third objection, founded on the curable, the variable, and the suddenly fatal nature of the disease, and on the relief which follows an attention to its ordinarily received causes, has been, in some measure, answered by the preceding observations. If the enlargement of the glands is trifling, and the disease is consequently in an incipient state, the removal of the exciting causes of the paroxysms will occasion a subsidence of the tumefied glands, and the tonics and change of air alluded to will powerfully contribute to ameliorate the scrofulous or chachectic state of system, which acts as the predisposing cause of the disease, and thus its curable nature may be explained. The malady being sometimes suddenly fatal, may perhaps be accounted for by the rapid enlargement, from an inflammatory process, of some one or two glands which press more particularly upon the recurrent nerve.

In concluding these transient remarks upon Dr. Ley's theory of the pathology of laryngismus stridulus, it is right to state that they give but a meagre account both of the hypothesis itself and of the arguments and illustrations by which it is supported, and that no one should presume to form any conclusions as to the truth of the hypothesis without giving a most attentive perusal to the highly scientific work in which it is promulgated. Dr. Ley's views are as yet so recent that sufficient time has not elapsed for bringing them to the test of observation and experience; if future investigations shall prove the universal coincidence of the symptoms of laryngismus with an enlargement of the bronchial or cervical glands, we shall be justified in viewing them in the light of effect and cause; the probability that this connection exists between them has, in my opinion, been made manifest.

A succession of symptoms closely resembling those of laryngismus stridulus, and frequently terminating in death by suffocation, is said to be produced by an enlargement of the thymus gland in children from the age of three weeks to that of eighteen months. The characteristic signs of this affection are thus described by Dr. Montgomery;¹ "Children in apparently good health, and who have even attracted attention by their florid complexion and high condition, are observed, when thwarted, frightened, awaking from sleep, or swallowing, or when under the influence of any mental emotion, to become all at once violently agitated; the hands are thrown up; the features become fixed, the eyes staring, and the breathing suspended; in a short time the fit ceases, and the respiration and vital power are restored, or the infant drops its head on the nurse's shoulder and dies. The first thing which occurs when the paroxysm ceases, is a slight, fine, whistling inspiration, as if the respiratory act was for the first time established." This disease is

¹ Dublin Journal of Medical Science, July 1836, p. 431.

most frequently met with in scrofulous children, and in the children of scrofulous parents; it occasionally happens that several children of the same family take it in succession. Other causes are said to be, all diseases affecting the function of respiration, dentition, disordered bowels, and enlargement of the mesenteric glands.

Dr. Kopp, and Dr. Hirsch, of Königsberg,¹ and Mr. Hood of Kilmarnock,² have also described this disease in terms very similar to those of Dr. Montgomery; and their united observations seem to show, if not the identity of the malady with laryngismus stridulus, at least that the symptoms are equally caused by a temporary closure of the glottis. It is remarkable that the predisposing and exciting causes of both diseases, and the immediate causes of the paroxysms are, according to the accounts given in the works just quoted, precisely of the same character. The progress and termination of both diseases are likewise exactly similar; the fits of suffocation in *thymic asthma*, which is the name the Germans have assigned to that form of laryngeal affection dependent on the enlargement of the thymus, are at first of rare occurrence, becoming afterwards more frequent and more easily induced, till they reappear at length ten or twenty times a day. As the disease advances it becomes complicated with general epileptic convulsions and with carpo-pedal contractions, and in this stage death commonly occurs in a fit of apoplectic suffocation, and often is quite instantaneous, without the slightest precursory symptom.

The lesions observed on examination after death are, 1st. The usual signs of asphyxia, such as a livid appearance of the skin, and congestion of the brain and lungs; and 2d. Hypertrophy of the thymus gland. The increased development of this gland takes place both in length and breadth, but most of all in thickness. The ordinary weight of the thymus at birth is about half an ounce, but in some of the cases of thymic asthma it has been found to weigh two ounces;³ in one of Kopp's cases "it might have been mistaken for the lung, it was so thick and hypertrophied; it extended from the thyroid gland to the diaphragm," and pressed strongly against the trachea.⁴ The diseased state of the thymus is either one of pure hypertrophy without alteration of texture, or the gland is denser, redder, and more fleshy than natural; on cutting into it there occasionally exudes a milky liquor. We are not informed, by any of the observers of this disease, in what condition the thoracic and cervical glands were found, therefore we have no right to presume that they were enlarged; at the same time it is more than possible that such enlargement existed and was overlooked at the inspection of the bodies. For, in the first place, all the subjects of thymic

¹ Not being able to procure the original works of these authors, I have been compelled to trust to the abstract of them given in the *Dublin Journal of Medical Science* for July, 1836.

² *Edinburgh Journal of Medical Science*, vol. iii.

³ Montgomery, *lib. cit.*, p. 433.

⁴ *Dublin Journal of Medical Science*, July, 1836, p. 514.

asthma were of the strumous diathesis, and on that account very liable to enlargement of the absorbent glands; in the second place, tumefaction of the deep seated cervical or thoracic glands may easily pass unnoticed when the attention of the person who conducts the examination is not speedily directed to the point; and, in the third place, the discovery of so striking a lesion as hypertrophy of the thymus would probably prevent a farther search after the cause of the symptoms which preceded death, and on this account enlargement of these glands, if it existed, might remain undiscovered, or if discovered, might not be thought worthy of remark. I have referred to the state of the glands in the neck and chest, because there can be little doubt, from the identity of the symptoms of thymic asthma with those of ordinary laryngismus, that in both cases they have the same cause; and if in the latter, the closure of the glottis is owing to pressure on the recurrent nerve, it is so in the former disease likewise.

Is the enlarged thymus sufficient to account for death by the pressure it exerts on the nerves or vessels of the neck? The thymus gland, it will be recollected, occupies the anterior mediastinum, and in the new-born infant extends from the thyroïd gland nearly to the diaphragm; it is in contact posteriorly with the trachea, the left subclavian vein, the vena cava, the arch of the aorta, and the pericardium, and if enlarged either by a temporary cause or permanently it must press upon the organs just mentioned, as the sternum, with which the thymus is in contact anteriorly, prevents any yielding in that direction. At the upper part of the chest, on a level with the top of the sternum, an increase in the bulk of the thymus must cause serious pressure on important organs, and if the already augmented size of this gland is suddenly still farther increased by an unusual flow of blood into it, from mental excitement or any similar cause, the return of venous blood from the head may be so much obstructed as to produce a fatal attack of apoplexy. This is, in all probability, what happened in many of the cases recorded by the writers on this disease, for death sometimes took place too rapidly even for suffocation; Dr. Montgomery, speaking of a child who had been for some time subject to attacks of suspended respiration from enlarged thymus, says, "One morning when at the breast, and apparently as well as possible, its head dropped back on its mother's arm; she immediately ran towards the window, but before she could get there every sign of life had ceased, without fit or struggle of any kind." Dr. Hirsch records a similar instance, and in another place observes that "death is often quite instantaneous, without the slightest precursory symptoms."

With respect to those cases in which death is caused by suffocation, and in all of which this event is preceded by symptoms indicating an impervious state of the rima glottidis, it is highly probable that pressure on the nervus vagus before it has given off the

¹ Op. cit. p. 32.

recurrent branch, or on the recurrent soon after its separation from the parent trunk, may occasion the closure of the rima. Dr. Montgomery mentions this as one mode in which the enlargement of the thymus may impede the function of respiration; he speaks of great and dangerous pressure exercised "on the trachea, by which respiration is impeded; and on the important nerves in that situation, especially the sympathetic, the par vagum, and its recurrent branches." "This latter agency, especially when exercising its influence in conjunction with the others just mentioned, it seems to me reasonable to believe, must contribute to the remarkably rapid extinction of the powers of life." Dr. Hirsch thinks the symptoms are occasioned by "tonic spasm of the lungs, larynx, and glottis," caused by pressure exercised by the hypertrophied thymus on the heart, the lungs, and the large arterial and venous vessels, with which organs the gland is, in some cases, found to have contracted morbid adhesions. The condition of the recurrent nerve is not, in any instance, mentioned, so that we must remain in ignorance whether it could have suffered paralysis from pressure.

The probability that Dr. Ley's views of the pathology of laryngismus stridulus are correct is strengthened by a consideration of the circumstances attending the thymic asthma: the identity of the symptoms in the two maladies must depend on an identity of cause; and where is this to be found? Not in the brain, which, in the latter disease at least, is unaffected for some time after the first occurrence of the paroxysms; not in an inflammatory affection of the roots or trunk of the laryngeal nerves, for this lesion is not found, nor is its existence probable; not in spasmodic action of the muscles of the glottis from irritation occasioned by teething or disordered bowels, for though the latter states sometimes exist in connection with the suffocative fits, most frequently the thymic asthma occurs independently of such complication. Paralysis of the dilators of the rima glottidis would account for the symptoms, and in both maladies there appears to be a cause sufficient to induce it, viz. the increased development of organs in the neighbourhood of the recurrent nerve, which, owing to their augmented bulk, are capable of making pressure upon this nerve.

Thymic asthma is a more fatal disease than laryngismus stridulus; the prognosis is almost always unfavourable: however, when the patient is robust, the case recent, the paroxysms weak and remote, and when there are no convulsive symptoms, hopes of effecting a cure may be entertained. The existence of an enlarged thymus gland as a cause of the laryngeal distress may probably be manifested by increased fulness in the lower part of the neck, between the inferior attachments of the sterno-mastoid muscles, and by dulness of percussion over the upper half of the sternum and the cartilages of the ribs on each side of this part of the bone. In some instances the increase in the size of the thymus has been such

as to prevent the pulsations of the heart from being heard by means of the stethoscope.

Treatment.—The indications to be attended to in the treatment of laryngismus and thymic asthma are, 1st. To remove the paroxysm; 2nd. To remove the exciting causes of the paroxysm; and 3rd. To attack the source of the disease.

The removal of the paroxysm is a part of the treatment which must generally be left to the mother or nurse, to those, in fact, who are constantly with the patient, as the duration of the fit is seldom so long as to allow of the arrival of a medical man, unless he should happen to be in the house at the time. The first thing to be done is to raise the patient and to place him in a sitting posture, or to incline the body forwards, so as to allow the respiratory muscles their full power; then he must be slapped on the back, cold water must be thrown in his face, and strong smelling salts held to his nose; these measures tend powerfully to stimulate the organs of respiration and to produce crying, sneezing, or some other strong expiration, on the occurrence of which the glottis is expanded, and the fit terminates. Other means that may be adopted if the paroxysm does not yield to the remedies just proposed are, the warm bath and the exhibition of an emetic, both of which, either separately or combined, will frequently give efficient relief.

If none of the measures here proposed are attended with success, the operation of tracheotomy has been suggested as an advisable means of giving relief, but I am not aware of its having ever been performed in this disease.¹ Mr. Porter thinks it is not justifiable as long as respiration is carried on even with the greatest difficulty; "for," observes this author,² "in almost every case in which the rima remains so far unclosed as to allow of a partial transmission of air, we may be satisfied that the spasm is not severe, and that the infant will struggle through it."—"But if the child is to all appearance dead, and if the practitioner is called to him within any reasonable time, he should then, with the least possible delay, endeavour to inflate the lungs and restore animation by whatever means shall appear to be the speediest, and of these perhaps the most preferable will be laryngotomy." At all events, this procedure, if unsuccessful, can do no harm, and it seems as reasonable to expect a recovery from the immediate adoption of active measures in this as in any other case of suspended animation.

The second indication in the cure of this disease is to remove the exciting causes of the paroxysm. Many of these exciting causes are things which should be avoided rather than removed;

¹ Dr. Ley, in his work on the Laryngismus Stridulus (note, p. 273), says, that Dr. Marsh mentions this operation having been performed with success by his friend Dr. Johnson. I can find no such statement in Dr. Marsh's paper, but merely one to the effect that Dr. Johnson had seen a child in a state of asphyxia caused by this disease recovered from apparent death by the instantaneous application of artificial respiration.

² Pathology of the Larynx, &c. p. 54.

within which class must be placed mental emotion, suddenly awaking the little patient, a careless manner of giving food, and an exposure of the surface of the body to cold. These are matters which, though apparently trifling, require extreme attention and the most watchful care on the part of the more immediate attendants on the patient; they demand a system of moral management chiefly, under which the temper of the child must be preserved as unruffled as possible; amusement must be afforded without producing excitement; and both the quantity of food and the manner of administering it must be properly regulated. Violent exercise and strainings of the body should also be discountenanced as much as possible, for, by causing a temporary closure of the rima glottidis, they may bring on a paroxysm.

The other exciting causes are of a more remote kind, but undoubted in their operation, and requiring medical skill and attention for their removal: they are chiefly dentition, bronchitis, disordered stomach and bowels, and cutaneous disease of the scalp. Dentition is by far the most frequent source of the paroxysms of the croup-like respiration, and a free division of the gums, so as to reach the rising tooth, will be necessary in every case where there exists a reason for suspecting even that this affection is owing to the process of dentition. I am aware that the propriety of this advice had been frequently questioned, and that it has been recommended to delay the operation till the tooth is about to penetrate the gum, lest, from the healing of the gum over the tooth, a cicatrix should be formed, which would offer a serious impediment to the advance of the tooth. Many of the best authorities on this subject agree, however, that cicatrices in such situations yield with more readiness to the pressure of the advancing tooth than the sound gum, and that the process of dentition will go on after the operation "with at least equal celerity, and certainly with greater immunity from suffering."¹ To prevent the speedy healing of the gum, it has been proposed to use a blunt lancet in preference to one with a fine edge, and the success of the operation has been said to depend greatly upon the bad edge of the instrument.² I believe it is a matter of little importance what kind of instrument is made use of, so that the gum is perfectly and freely divided down to the rising tooth.

Bronchitis, when it appears to act as an exciting cause of the laryngeal affection, requires prompt attention, but the treatment must be the same as would be adopted for the relief of the disease under other circumstances. A regulated temperature, depressing medicines, and the application of leeches and counter-irritants, when necessary, form the basis of the treatment that bronchitis might require.

Disordered stomach and bowels, and especially flatulent distension of these organs, is a very common cause of the paroxysms

¹ Ley, p. 242.

² North, p. 275.

of laryngismus. In endeavouring to correct this state of the digestive function we should bear in mind the usually cachectic or scrofulous constitution of the patients, and on this account abstain from the administration of irritating and drastic purgatives; at the same time constipation must be removed, and if the milder aperients prove insufficient for this purpose we must have recourse to those of a more efficacious character. The bowels should be regulated, not drained; violent purgation is, in almost every instance, to be avoided. "If we have evidence of hepatic derangement, and the stools are of an unnatural appearance, a grain of calomel each night may be given with much advantage."³ The removal of flatulence must be attempted by the exhibition of aperients and antacids, and occasionally of the stimulating antispasmodics, such as assafoetida, tinctura fuliginis, and sp. ammoniæ foetid., medicines which are essentially serviceable, by causing the expulsion of the flatus accumulated in the alimentary canal. The prevention of flatulence and of disordered secretions in children who are subject to attacks of laryngismus, is a matter to which the attention of the practitioner should be constantly directed; it is accomplished by the enforcement of strict rules of diet, by the combination of alkalies and tonics, and by exercise and change of air, principally. No particular or universal rules can be laid down on this subject, as the treatment must vary with each individual case.

The cutaneous diseases of the scalp which contribute to the production of the paroxysms in this disease are generally such as require a soothing mode of treatment; and as there is much reason to believe that enlargement of the cervical glands is instrumental in bringing on the attacks of laryngismus, the cutaneous irritation, which is one of the causes of this enlargement, should be allayed by poultices and emmollient applications in the first instance, and the cure may afterwards be accomplished by a mild mercurial ointment, or by other measures the efficacy of which has been proved by individual or general experience.

Head affection.—The treatment of head affection, whether it occurs as a cause, a complication, or a consequence of laryngismus, must be regulated by those general principles with which medical men are now thoroughly familiar, and into the particular consideration and discussion of which it would be useless for me to enter. When undoubted signs of inflammatory disease within the head precede or accompany the attacks of croupy respiration, it will be necessary, of course, to adopt strong antiphlogistic measures, and their nature and the extent to which they are carried must be determined by the state of the pulse and the degree of disturbance of the cerebral functions. We should, however, at the same time, be cautious in concluding too hastily that strabismus, carpo-pedal contractions, or even epileptic convulsions, are invariably symptomatic of cerebral excitement; in the disease now under considera-

tion, these affections seldom show themselves till the paroxysms of impeded respiration have become of frequent occurrence and the balance of the circulation within the head is disturbed in consequence. Nevertheless, it may still be advisable, in some cases, to take away blood for the purpose of relieving the congested state of the vessels of the brain, or to act powerfully upon the bowels and kidneys, to assist in causing the absorption of any fluid that may have been deposited within the cavities of the brain. The employment of these means requires great caution and discrimination, for the recorded experience of the most able writers on this disease shows that, except in robust children, they are more frequently attended with mischief than otherwise.

The third indication of cure is to attack directly the cause of the disease, but till its pathology is more clearly ascertained, our efforts towards the fulfilment of this object will necessarily be directed somewhat at random, or at least guided by circumstances the exact importance of which we are yet scarcely able to appreciate. Scrofula, insufficient or improper nourishment, disease of the cervical or thoracic absorbent glands, and hypertrophy of the thymus gland, have each been pointed out as predisposing or exciting causes of this disease; and though it would far exceed the limits which I have assigned myself to enter at length into a consideration of the treatment of these affections, it is necessary to offer a few general remarks upon the subject in reference to their connection with laryngismus stridulus.

Scrofula.—Indications of the existence of scrofula, or of the strumous diathesis, have been observed in a large majority of the cases of this affection of the glottis; it is, therefore, a fair presumption that the connection between them is immediate and direct. The adoption of measures for the removal of this state of constitution should, on these grounds, be resorted to immediately that the symptoms of laryngismus display themselves; and where one or two members of a family have already suffered from attacks of the laryngeal affection, these measures are called for in the way of precaution against the incursions of so formidable a malady. Scrofula being a constitutional disease, and when thoroughly established, exercising its malignant influence upon almost every function of the animal body, requires a most extended plan of treatment in order to combat it with any probability of success. The climate or situation, the diet, the clothing, and the direct medical treatment, would each require a separate consideration in a treatise devoted to the investigation of this disease; but the subject is much too extensive for a work which professes only to treat on the diseases of the larynx and trachea.

Scrofula is essentially a disease of debility, and must be counteracted by the selection of a dry and airy situation for the patient to inhabit—the country being generally far preferable to the town; by the adoption of a diet suited to the age of the patient and to the weakened condition of the digestive organs; by warm clothing at

all times, but especially during the colder seasons of the year, when nothing less than the completely covering both the body and extremities of the child with flannel should content us; and by the exhibition of medicines which increase the power of the digestive and assimilative apparatus, correct the secretions, and regulate the action of the bowels. A plan of treatment founded on this slight sketch will seldom fail to relieve incipient cases of the croup-like respiration, unless the disease is kept up by any of the local affections which have already been mentioned under the head of exciting causes. Dr. Marsh observes with regard to this point, that the "symptoms in such cases will rarely fail to yield to some of the vegetable or mineral tonics, pure and bracing air, and a well-regulated diet."¹ He dwells with particular emphasis upon the advantages of pure country air, and of quinine given internally, which medicine he appears to prefer as a tonic to all others. Many authors recommended the mineral tonics, especially the preparations of iron and zinc, on account of their antispasmodic powers and the supposed necessity that exists for remedies of this character.

Insufficient or improper nourishment.—The proper diet for an infant previous to the cutting of the teeth, and for some time after the commencement of this process, is that which nature has destined for its support, the mother's milk; and when, owing to defective organisation, to delicacy of constitution, or any similar impediment, on the part of the mother, the duty of suckling her offspring cannot be efficiently performed, a healthy wet-nurse must be obtained. This remark, though made generally, is meant to apply, of course, to the subjects of the disease we are engaged in considering. I have before quoted the observation of Dr. Clarke, that this malady seldom attacks children who have been suckled till they have cut several of their teeth; and numerous instances might be mentioned, in which the substitution of a good breast of milk for feeding by hand, or the changing of the nurse, has put a stop to the attacks of this disease, when in an incipient state. If the circumstances of the patient will not allow of the procuring a wet-nurse, the diet of the infant must be a matter of experiment; for the alimentary substances which, in one instance, agree well with the patient, will in another be productive of serious disorder. Milk, cream, sugar, leavened and unleavened bread, gruel and animal broths, alone or mixed in various proportions, are the chief resources we have to trust to, and their adaptation to each individual case demands a frequent and attentive examination of the appearance of the child and of the nature of its intestinal secretions. The diet of children subject to this disease, who have passed the period of suckling, requires the most anxious management, but it is clearly impossible to lay down any rules on this subject of universal or even general application; the circumstances of each individual case afford the only practical guide.

¹ Op. cit. p. 647.

Enlargement of the thoracic or cervical absorbent glands is, according to the experience of Dr. Ley, discoverable in nineteen out of twenty cases of this disease. I have already spoken of the treatment of some of the various affections on which enlargement of these glands frequently depends, such as bronchitis, diseases of the scalp, scrofula, &c., and of course the removal of all sources of irritation is the first step towards effecting the reduction of the tumefied glands. If any one or two of the cervical glands are in a state of inflammation they must be treated by leeches, fomentations, and poultices; if the enlargement is chronic and unattended by heat or pain, besides the constitutional remedies for scrofula before mentioned, we may have recourse with advantage to the external and internal employment of iodine in many cases. The hydriodate of potass ointment is the best form for external use; it may be rubbed twice or three times a day over the sides of the neck, the clavicles, and the upper part of the sternum. For internal exhibition, I prefer the hydriodate of potass dissolved in water to any of the preparations which contain pure iodine; the latter are more disagreeable to the taste, and therefore less likely to be persevered with, subject to variations in their composition, and more apt to disagree with the stomach.

Hypertrophy of the thymus gland.—Our experience in the treatment of this disease is at present rather limited, but the remedies which have proved most serviceable are, leeches, applied repeatedly over the upper part of the sternum, to diminish the vascularity of the thymus; counter-irritation afterwards, in the same situation, either by means of the frequent application of ointment containing tartarized antimony, of a blister, to be kept running by stimulating dressing, or of an issue on the chest; friction with the hydriodate of potass ointment; a low diet, and frequent energetic purgatives. The antiphlogistic treatment must be modified according to the strength of the patient; and the general management of those children who are of delicate constitution, or of a strumous habit, must be regulated in the same manner as though the laryngeal affection depended on any of the other causes which have been specified.

II.—SPASM OF THE GLOTTIS FROM PRESSURE ON THE LARYNX AND TRACHEA, OR ON THEIR NERVES.

Cases of this kind, there is much reason to believe, are exactly similar to the laryngismus stridulus and the thymic asthma in the ultimate cause, as well as in the morbid phenomena which distinguish them; but as the term laryngismus stridulus has hitherto been used only to designate a certain train of symptoms occurring in infants and young children, I have thought it right to describe under a separate head those cases of croup-like respiration which take place chiefly amongst adults, and where the laryngeal obstruc-

tion has an obvious cause in the existence of a tumour pressing upon the air tubes or upon some of the laryngeal nerves.

The affection of the glottis comes on in paroxysms, which differ in no respect from those of the disease last described, except that they are aggravated, in appearance at least, by the terror and extreme mental distress of the patient, from the consciousness of danger with which his more developed understanding is so strongly impressed. I borrow the following highly wrought but faithful delineation of this affection from the work of Mr. Fletcher, of Gloucester.¹ "When first seised with spasm of the glottis the patient starts up suddenly, tossing his arms in wild affright; an expression of terror sits upon his countenance; the eye-brows are raised over balls that are starting from their sockets; the shoulders rise and fall as, with an open mouth and incredible exertions, air is drawn through the nearly-obstructed tube with a singular and alarming sound; not a word is uttered." The paroxysms vary in frequency and in duration according to the nature of the cause from which they arise; and between the periods of their occurrence the patient is generally free from all complaint. Most of the cases related by Mr. Fletcher were instances of spasm of the muscles of the glottis from irritation of an inflammatory nature in the immediate vicinity of the larynx, and the paroxysms of impeded respiration were very severe and of long continuance, and terminated fatally in four of the instances. The occasional occurrence of real spasmodic action in these muscles from inflammation being set up in their neighbourhood is unquestionable, but cannot be said properly to come under our notice in this place: the paroxysms of croupy breathing arising from such a cause are unusually severe; their source is generally indicated by the pain and swelling attendant upon the original disease; and their relief, which may sometimes be obtained temporarily by the hot bath and a powerful dose of opium, can be completely effected only by the removal of the local inflammation or abscess which has given rise to them. An attentive examination of the fauces and pharynx, and of the exterior of the throat, will, in most instances, bring to light the original disease, and its treatment must be directed by the principles of surgery. If the examination render it probable that an abscess has formed in either of the situations just indicated, an incision should be immediately made with the view of evacuating the matter.

Other causes of that temporary closure of the glottis which has usually been described under the name of spasms are, foreign bodies in the œsophagus,² irritable bronchocele³, and aneurism of the arteria innominata.⁴ In the case related by Mr. Lawrence, where death ensued from this affection of the glottis in consequence of the

¹ Medico-Chirurgical Notes and Observations, p. 3.

² Pelletan, Clinique Chirurg. tome i. p. 13.

³ Fletcher, Medico-Chirurgical Notes and Illustrations.

⁴ Lawrence, Medico-Chirurgical Transactions, vol. vi. p. 227.

pressure of an aneurism of the arteria innominata, the patient was, for a fortnight preceding her death, subject to fits of difficult inspiration, between which she was free from all complaint. "Her breathing and pulse were nearly natural, she had no pain, and, excepting a degree of debility produced by the preceding attacks, there was no mark of disease or disorder about her." She died suffocated on the night following her admission into the hospital. After death, an aneurism of the arteria innominata was found pressing on the trachea, the front of which tube was pushed in by the tumour, so as to present a convex prominence on the inner surface, which, however, diminished its area in a very slight degree. In a case that occurred under my own observation, the patient was subject to paroxysm of severe dyspnœa, attended by loud croupy inspirations and a sense of imminent suffocation, for three months previous to his death, which occurred in one of the fits. On a post mortem examination, there was found a large aneurism of the ascending aorta and the arch; it projected forwards and upwards, extending behind the right clavicle and making pressure upon the arteria innominata, the area of which was considerably diminished, and upon the trachea, which had, however, undergone no organic change in consequence. In both these instances death was the result of suffocation from undue action of the muscles that close the rima glottidis, and it is highly probable that the closure of the glottis was owing to pressure upon the recurrent nerves; for in neither case was the area of the trachea affected in a sufficient degree to account for the impediment to respiration; and simple pressure upon the front of the trachea is not of itself capable of inducing spasm of the glottis. This is proved by a case narrated by Mr. Lawrence, in which an aneurism of the aorta was found after death pressing on the trachea, "so as to produce ulceration of the internal membrane, under which there was a slight appearance of coagulated blood." The patient died of a different complaint, and had never had any affection of the breath.¹ In this instance the aneurismal tumour was very small, and this circumstance increases the probability that, in the other cases, the dyspnœa was produced by pressure on the recurrent nerves; for a small aneurism "rising out of the arch of the aorta" would not impede the functions even of the left recurrent nerve, whilst larger tumours of the same kind, situated between the upper bone of the sternum and the nervous trunks at the root of the neck, would, there is much reason to believe, seriously affect the functions of these latter organs.

The diagnosis of these cases is easy when the tumour which gives rise to the symptoms is apparent externally, but under other circumstances it will be attended with some difficulty. The absence of pain on pressure in the laryngeal region, and of general febrile symptoms, will prevent us from confounding these cases with those of inflammatory disease of the larynx. The inspiratory part of the

¹ Medico-Chirurgical Transactions, vol. vi. p. 228.

process of respiration being exclusively affected, will enable us to distinguish between spasm of the glottis and the dyspnœa which results from the presence of a foreign body in the trachea. In order to discover the organic mischief which occasions the spasm, an accurate examination of the condition of the arch of the aorta and its large branches should be made, with a view to detect any aneurismal enlargement that may exist in these vessels; if none such is found, and if no tumour of any kind can be felt at the lower and front part of the neck, it will be proper to examine by the touch the course of the recurrent nerves between the trachea and the œsophagus, as tumefaction of the absorbent glands in this situation will occasion pressure upon the recurrents. The detection of enlargement of these glands is, however, rendered difficult by the distance from the surface at which they are placed, and by their being covered by the strong fascia of the neck. In a case mentioned by Dr. Rush,¹ severe paroxysms of dyspnœa were caused by an enlarged gland thus situated, and though the real cause of the symptoms was conjectured before death, the swelling of the gland could not be detected by external examination.

In the majority of cases of this affection very little can be done to mitigate the sufferings of the patient, because it is impossible, in most instances, to remove the disease in which the laryngeal symptoms have their origin. Where this can be safely done, it will, of course, be the first object to which our attention should be directed. The question as to the performance of tracheotomy in these cases must be decided, in a great measure, by the view the practitioner takes of the pathology of the disease; because, if he ascribes the impeded respiration to pressure on the trachea, no operation of the kind alluded to can, according to his opinion, afford even temporary relief; but if, on the other hand, he believes the symptoms to arise from closure of the glottis caused by pressure on the recurrent nerves, he will, in many cases, be justified in recommending the incision of the trachea for the purpose of prolonging life, even though he is aware that the fatal termination can thus be only postponed.

Every precaution should be taken to prevent the recurrence of the suffocative paroxysms; agitation of mind, irregularities of diet, and great muscular exertion, must obviously prove exciting causes of the fits, especially when they have their source in aneurism, and they must, therefore, be sedulously avoided. Perfect quiet, an inclination of the body forwards, the warm bath, and opiates, are measures which may be resorted to during the continuance of the paroxysm.

¹ Medical Observations and Inquiries, vol. v., p. 96.

CHAPTER XII.

HYSTERICAL AFFECTIONS OF THE LARYNX.

THE larynx is subject to two kinds of functional derangement, which are dependent on hysteria or on a disordered state of the menstruation. The first of these is an irritable condition of the muscles of the glottis, with a disposition to spasmodic action in those especially which close the rima; the second consists in deficient power of the same class of muscles, whence a temporary or permanent state of aphonia results.

Spasmodic affection of the laryngeal muscles.—An excessively irritable state of the larynx, attended by frequent attacks of spasmodic closure of the glottis, is often met with in young hysterical females who are subject to irregular menstruation. The paroxysms, for the most part, come on in the evening; they consist generally of a long continued, loud, and convulsive cough, sometimes followed by stridulous inspiration, and of a difficulty of breathing so great as to threaten suffocation; they will continue sometimes “for two or three hours without interruption, and not cease till the patient falls into a swoon, or even into convulsions.”¹ Occasionally the paroxysm terminates in one of the ordinary hysterical fits. I have never heard of a case of hysterical spasm of the glottis ending fatally; but the dyspnœa is sometimes so great, and the danger of suffocation apparently so imminent, that it has been proposed by Dr. Albers, of Bonn, to perform tracheotomy for the relief of the patient. In one instance this operation was attempted by an eminent provincial surgeon; the patient, a young woman, was suddenly seized towards evening with cough, sonorous respiration, and symptoms of threatened suffocation. Tracheotomy was immediately determined on, but when the operator had made his first incision through the skin and cellular membrane in front of the trachea, all the signs of obstructed respiration instantly disappeared. Sir Charles Bell, in his *Surgical Observations*,² records an interesting example of threatened suffocation from spasm of the glottis occurring as a symptom of hysteria in a young woman, and Mr. Porter alludes to the same affection in more general terms. He says, “I have seen hysteria in one or two instances produce symptoms bearing a strong resemblance to chronic laryngitis, but this is easily discovered by paying even a slight attention to the progress of the disease.”³ But laryngitis, both acute and chronic, may occur in hysterical females, and the inflammatory affection will, in such cases, be modified by the peculiar state of the patient’s constitution. Idiopathic chronic laryngitis occurs more frequently, according to

¹ Mr. Wood, *Medico-Chirurgical Transactions*, vol. xvii., p. 170.

² Vol. i., p. 40.

³ *Pathology of the Larynx, &c.*, p. 122.

my experience, in women who are the subjects of irregular or suspended menstruation than in any other class of persons; and it is highly probable that the irritability of the glottis and the loud spasmodic cough which accompanies the disease, may be in a great measure attributable to this species of complication. In the following case, for example, inflammation of the mucous membrane of the larynx was evidently complicated with hysteria, and its symptoms were much aggravated by the circumstance.

CASE.

December 23d, 1835. Ellen H——, aged twenty-nine, domestic servant, has very frequent, long continued, dry and irritating cough, followed each time by a stridulous inspiration; respiration at other times natural; pain and heat in the laryngeal region, soreness on pressure; pain and soreness always increased by the cough and by talking; voice hoarse and weak, pulse quick, skin hot, thirst, and general fever; deglutition difficult and painful. No appearance of inflammation about the fauces. She first felt herself poorly yesterday; was seized before noon with shiverings, and directly afterwards was sensible of uneasiness in the throat and difficulty of swallowing: cannot assign any cause for her illness. During the night was altogether worse, and became better again in the morning. To apply twenty leeches to the sides of the larynx, and to take calomel and opium every three hours.

24th, noon. She has passed a very uneasy night, being much troubled with the cough. Complains of thirst and headache; the cough is no better, but is still followed each time by the same sonorous inspirations; can swallow liquids with comparative ease. Solids produce pain in their passage; cough always comes on after the act of deglutition; voice not so hoarse, still weak. To continue the medicine and apply a blister to the lower part of the neck.

25th. Much better as to the throat; cough still troublesome, but no longer followed by the stridulous inspirations. Feels very low and sinking: there is still some tenderness about the larynx and pain in swallowing. To omit the calomel and take a mixture with ipecacuanha and trœ. hyoscyami.

26th. Last evening the patient had two strong hysteric fits, and upon inquiry I find that she began to menstruate on the 20th, but the catamenia ceased on the following day. The bowels have been violently purged during the night; the pain and difficulty in swallowing, the pain in the throat, the cough and sonorous respiration, seem all to have vanished with the fits.

January 3rd, 1836. Since the last entry there has been no return of difficult or sonorous inspiration, but the patient is still occasionally troubled with cough. Salivation occurred on the 27th, and the bowels became very much disordered; these effects of the

mercurial treatment have now passed away, and the patient is convalescent.

Remarks.—There can be no doubt that, at its commencement this was a case of laryngitis; the pain and soreness of the larynx on pressure, the painful deglutition, and the signs of general fever, all indicate an inflammatory affection of the larynx; whilst the long continued, dry, and irritating cough, followed each time by stridulous inspirations, the freedom of the respiration at other times, and the nocturnal exacerbation of the symptoms, are attributable mainly to the influence of the hysterical constitution of the patient, which was subsequently manifested in the usual way. The hysteric fits were followed by a cessation of all the laryngeal symptoms, except the cough.

This irritable state of the larynx and the disposition to spasm of the muscles of the glottis, when dependent on hysteria or disordered menstruation, may, in a general way, be readily distinguished from chronic laryngitis by the absence of pain and soreness in the laryngeal region, as well as by the paroxysmal nature of the attacks. The complaint is much more distressing than dangerous, and tracheotomy cannot be rendered necessary for its relief by any thing short of absolute suffocation. During the paroxysm the patient should be subjected to the usual treatment of hysteric fits; cold water thrown over the face and neck, the application of strong ammoniacal salts to the nostrils, or the exhibition of a powerful emetic,¹ are likely to give relief at the time; and the recurrence of the attacks must be prevented by measures directed to the improvement of the general health, and more particularly to the amelioration of any disorder that may exist in the menstrual function.

Aphonia.—Hysterical females are occasionally affected with a total loss of voice: this symptom is unattended by any appreciable disease in the larynx; "it takes place suddenly, continues often for many months, even for one or two years, and then disappears as suddenly as it began. A patient thus affected may, when under the influence of strong moral excitement, find herself speaking in her natural voice when for some time before she had spoken only in a whisper. Her recovery may be permanent, or she may relapse into her former condition."² In some instances the aphonia appears to be dependent on some form of dysmenorrhœa; in others it seems to have its origin in a highly nervous and debilitated condition of the system, resembling in such cases the loss of voice that succeeds to violent diarrhœa, or sudden and profuse hæmorrhages. Sir B. Brodie observes that this affection "is not unfrequently met with in the male sex, especially in those of the clerical profession, probably because they often lead very sedentary lives, and also

¹ Wood, *Medico-Chirurgical Transactions*.

² *Lectures on certain Local Nervous Affections*, by Sir B. C. Brodie, Bart., p. 51.

because in their profession they are called upon to speak in public in a tone raised above the ordinary standard."

The following instances will illustrate some of the forms of hysterical or nervous aphonia as it occurs in the female sex :—

Harriet Brittain, aged 14, servant, applied to me on account of a sudden and total loss of voice : she could speak only in the faintest whisper : there was no pain or tenderness about the larynx, nor any cough. On enquiring particularly as to the state of her health, I learned that the menstruation was scanty and attended with pain and considerable febrile excitement ; that the catamenia were then flowing, and that on the only two occasions when she had menstruated, her voice had failed her exactly in the same manner, the aphonia beginning two days before the menstrual period and continuing during the whole of it. My efforts were successfully directed to the relief of the dysmenorrhœa ; and although the state of voicelessness returned at the fourth menstrual period, it never afterwards occurred.

In another case, the patient, a young woman, aged 20, had never properly menstruated, but every month, when the catamenia should have flowed, there was slight leucorrhœal discharge, flatulent distension of the abdomen, and loss of voice. She was completely cured by the establishment of the proper menstrual discharge. In the succeeding instance, no cause whatever could be discovered to account for the aphonia.

Sarah Haywood, aged 22, japanner, had completely lost her voice when she came under my care ; her utmost efforts could only elicit so faint a whisper, that it required that the ear should be placed quite close to her mouth to ascertain that she was attempting to speak. This state had lasted three months ; it was unaccompanied by any appreciable disorder of the uterine, digestive, or sensorial functions. Nine months previously she had had a similar attack, which continued a fortnight, and yielded speedily to galvanism. On the present occasion the same remedy utterly failed, though tried most powerfully. A variety of other measures were put into requisition, but without the slightest beneficial effect.

In another instance the state of aphonia continued more than twelve months, but the power of speech returned on the removal of a highly hysterical condition, into which the patient had fallen after a severe and debilitating illness. She regained her voice three or four separate times during this period, but never for longer than a few minutes each time.

A sudden suppression of the menses will sometimes induce this affection of the vocal organs. Henriette Maillet, aged 20, first began to menstruate at the age of 17, but the discharge had always been irregular, and trifling in quantity. Towards the end of May, 1831, this girl went into the country on a party of pleasure, whilst the menses were flowing, and became chilled ; her throat was sore in the evening, but she passed a comfortable night ; on the following morning, however, when she awoke, the menses were sup-

pressed and the voice totally gone. On the 29th of August of the same year she became a patient of M. Trousseau, at the Hotel Dieu de Paris: her voice still remained extinct; she had no pain in the larynx, nor any cough or fever. Various methods of treatment were resorted to, chiefly of an antiphlogistic or derivative nature, without producing any beneficial result; but a cure was ultimately effected in four days by the cauterization of the pharynx and upper part of the larynx.¹

The following case, which also fell under the observation of M. Trousseau, is an example of nervous aphonia in the male sex;

The patient, who was often obliged to speak in public and in a loud tone, noticed, two years ago, that his voice was apt to become weak from time to time; soon afterwards he was affected with continual hoarseness; by slow degrees the tone of the voice became more grave and less sonorous, till, about two months before he consulted M. Trousseau, the voice became totally lost, and had not returned since. The patient could not elicit any sound, even when he exerted himself to the greatest possible degree. The general health was perfectly good; there was no pain or swelling in the neighbourhood of the larynx, nor had the patient ever suffered from catarrh or hæmoptysis. Antiphlogistic and revulsive treatment had been extensively tried without being productive of any advantage; but ultimately the voice returned by degrees, under the cauterizing mode of treatment that was successfully adopted in the preceding case.

The predisposing causes of aphonia are hysteria, irregular menstruation, debility, and excessive exercise of the vocal organs. Its exciting causes are suppressed menstruation from cold, a violent fit of hysterics,² "sudden and overwhelming emotion of the mind from terror, anger, or any other passion,"³ chills from drinking largely of cold water,⁴ and the shock of a sudden fall.

The disease consists of a total exhaustion of nervous power in the muscles of the larynx, without any organic lesion whatever: it is unattended by indications of the existence of inflammatory action either in the muscles or in the mucous membrane. It may be distinguished from aphonia as the result of chronic laryngitis, by the previous history of the disease, by the absence of pain, heat, or swelling, by the occasional temporary return of the voice under strong excitement, and by the suddenness of the attack.

Treatment.—There are two indications of cure to be attended to in the treatment of this affection; the first is to amend the state of the general health, which will frequently be found to have suffered, and the second is to impart tone to the muscles of the larynx

¹ Abridged from the Journal des Connaissances Medico-Chirurgicales. Fevri, 1835.

² Wells, Medical Communications, v. ii. p. 501.

³ Good's Study of Medicine, art. Aphonia Atonica.

⁴ Smyth, Medical Communications, v. ii. p. 488.

and to bring them again under the influence of volition. In furtherance of the first indication we must commence by endeavouring to rectify the functions of any organ that appears to be deranged; flatulence, a costive state of the bowels, and any of the varieties of dysmenorrhœa, for example, should be removed as soon as possible by appropriate medicines. If the state of the system which predisposes to aphonia is solely dependent upon one, or upon a combination of these functional derangements, their removal will, in all probability, act favourably on the loss of voice. If the patient is decidedly hysterical, antispasmodics—such as valerian and assa-fœtida—and the metallic tonics should be given separately, or in combination: their use may be seconded by other remedies of known power, as the shower bath, horse exercise, cupping on the loins, &c., which must, however, be directed by the medical attendant according to the varying circumstances of each individual case. Those patients who labour under aphonia in consequence of pure debility from excessive discharges of any kind, will generally be relieved by a stimulant and tonic treatment, and the returning powers of the constitution will bring with them renewed powers of speech. The action of an emetic is reported in some instances to have restored patients suffering under this disease to a use of their voice immediately and permanently. Dr. Carmichael Smyth relates a case of this kind, in which instantaneous relief was obtained from aphonia of some months duration by the action of an emetic. He was induced to prescribe this remedy from having observed that the patient's tongue was a little white.¹

The local treatment of nervous aphonia is very imperfectly understood. The operation of local remedies appears to be uncertain in the extreme, and in scarcely any two cases do they produce similar effects. Blisters, rubefacients, issues; in short the whole class of revulsive and derivative applications have been extensively tried, and though apparently attended in some instances with success, they have completely failed in by far the majority of cases. Galvanism and electricity have also been frequently successful, and as frequently have failed: *a priori*, we should be led to expect beneficial results from their use, and I am inclined to think them well worthy of a full and long continued trial. The electric fluid should be directed along the course of the superior laryngeal nerves.

M. Trousseau, in the memoir before referred to, has strongly insisted on the benefit to be derived in these cases from the cauterisation of the pharynx and the upper part of the larynx. To effect this he proceeds in the following manner:—"A piece of sponge, six lines in diameter, is firmly tied to the end of a narrow strip of whalebone, which is bent to a right angle about an inch from its extremity. The sponge is then to be wetted with a saturated solution of nitrate of silver to such an extent that it will only let

¹ Medical Communications, v. ii. p. 489.

the liquid drop if gently pressed. These preparations being made, the patient must open his mouth as wide as possible, the base of the tongue is to be depressed with a spoon, and the sponge must then be brought into momentary contact with the upper surface of the larynx and the contiguous part of the pharynx. M. Trousseau has effected this cauterisation, as he terms it, of the larynx, many times, with no other disagreeable effect than the production of some degree of nausea, and of a metallic taste, which continues some time after the operation. I have already cited two cases of nervous aphonia which were apparently cured by this means: the same writer also relates the histories of some others which were either cured or greatly relieved by this plan.

We must always view with extreme caution any accounts of the sudden cure of affections which are merely *nervous*, because the suspended or disordered functions of organs, under these circumstances, are often restored or improved suddenly, and, as it were, spontaneously, without our being able to assign any adequate cause for the change. A mass of experience is, therefore, necessary to establish belief in the efficacy of such a mode of treating a disease, about the direct cause of which we are yet in comparative ignorance. The plan appears to be harmless, and may consequently be resorted to on the failure of other methods of treatment. It would seem likely to be more serviceable in those cases of weakness or dissonance of the voice, where the impaired functions of the vocal organs have their source in frequent catarrhal attacks, or in the combined influence of great vocal exertions and constant atmospheric exposure; always supposing no inflammation to be actually present.

CHAPTER XIII.

OSSIFICATION OF THE CARTILAGES.

Ossification of the thyroid and cricoid cartilages is not to be accounted a morbid condition when it is found in persons advanced in life; the conversion of these cartilages into bone is a natural process, which usually commences about the middle age, and goes on progressively till the change is almost entirely effected. If the ossification is unaccompanied by enlargement or thickening of the cartilages it is seldom productive of any other inconvenience than a slight alteration in the tone of the voice, which becomes husky or harsh. "In some instances, where the cartilages were converted into bone, there was a total inability to swallow, which destroyed the patients. On examination after death no disease was observable either in the pharynx or in the œsophagus."¹ Dr. Travers relates a

¹ Baillie's Morbid Anatomy, vol. ii. p. 107.

case of this kind in the seventh volume of the *Medico-Chirurgical Transactions*. The patient, a lady, aged 50, had experienced some degree of difficulty in swallowing for six months previous to her death, but during the last month she could scarcely manage to get down even a small quantity of liquid. Upon passing the index finger down the œsophagus, a projection could be felt filling up the whole of the tube. On inspection of the body after death the cricoid cartilages were found to be much increased in size and completely converted into bone, and by pressing upon the œsophagus they offered an obstruction to the passage of the food. The œsophagus was natural in appearance.

In this instance the cricoid cartilage was not merely ossified, but it was also much increased in size, and to the latter circumstance we must attribute the inability to swallow. The conversion of the arytaenoid cartilages into bone is an interesting feature of Dr. Traver's case, for this change is in them so rare that Andral remarks he is not aware they have ever been found ossified.¹ I have already mentioned an instance in which one of the arytaenoid cartilages was found, after death, ossified and carious (page 78), but such a lesion is of very infrequent occurrence.

"Ossification of the epiglottis is exceedingly rare, but a minor degree of induration is by no means uncommon, the effect of which is to render it less movable, so that it is with difficulty bent down to protect the aperture of the larynx."²

The cartilaginous rings of the trachea occasionally become ossified, and the effect of such a change of structure is to impair the flexibility of the tube, and to render more difficult the expulsion of any mucus which may accumulate within its cavity, as the muscular structure at its posterior part is unable any longer to contract the area of the tube. In the following case the uppermost rings of the trachea were ossified and carious:—

Richard Lutwyche, aged 75, was admitted into the Birmingham Town Infirmary on the 29th of June, 1836, on account of chronic bronchitis and general decrepitude. He died exhausted on the 5th of August. For some time previous to death he had great soreness about the upper part of the trachea, sibilant respiration, and a feeble veiled voice. On examination of the air passages, the larynx was healthy, except that the cricoid cartilage was quite converted into bone. The mucous membrane lining the anterior and superior part of the trachea was extensively removed by ulceration; the fibrous structure in this situation was also destroyed, so that the front boundary of the canal was formed by the integuments of the neck. The central part of the two upper rings of the trachea was absorbed, and the lateral portions on either side were seen loose and projecting into the area of the tube. Both rings were converted into bone and extensively carious. Two or three of the tracheal

¹ Pathological Anatomy, translation, vol. ii. p. 493.

² Andral, lib. cit. p. 492.

rings next in succession were ossified, but they had not undergone exposure to the air, and were not carious.

The slight attention that was paid to this case during life does not enable me to form an exact opinion as to the succession in which the morbid changes occurred. Probably the conversion of the cartilaginous rings of the trachea into bone was the first process, and the ulceration of the mucous membrane the second; the exposure and consequent caries of the ossified rings then admits of an easy solution, and the effect of the whole in enfeebling the voice and producing sibilant respiration is explained at once by the consideration that the upper part of the trachea, to the extent of at least half an inch, was rendered incapable of performing those contractions of its calibre which are necessary to urge the mucous secretions of the air passages towards the larynx.

When the cartilages of the larynx and trachea have undergone a conversion into bone, they become liable to any changes which might take place in ordinary bone, such as necrosis and exfoliation.¹

CHAPTER XIV.

TUMOURS OF THE LARYNX AND TRACHEA.

THERE are various species of accidental or morbid formations which may be developed within the cavity, or in the parietes of the larynx and trachea, but from the infrequency of their occurrence, and the undistinguishing character of the symptoms they give rise to, they generally remain undetected till after death.

Hydatids.—Most of the cases of hydatids in the larynx described by ancient writers are considered by Albers² to have been nothing but œdema of the glottis. Hydatids, however, have been found in the air passages, but in most cases they are originally formed in the lungs, liver, or thyroid gland, and subsequently burst into the air tubes. A hydatid developed in one of the ventricles of the larynx, has been known to project so far into the cavity of this organ as to give rise to all the symptoms which usually attend a foreign body there.³ Portal, in his *Traité de la Phthisie Pulmonaire*, relates an instance where suffocation was caused by the escape of hydatids from the thyroid gland into the trachea through an ulcerated opening in front of the latter organ.

Polypus.—By far the most common species of tumour found in

¹ Baillie's Morbid Anatomy, vol. ii. p. 83.

² See a translation of his paper "On Tumours of the Larynx" in the Gazette Médicale de Paris, Février, 1835.

³ Andral, Anat. Pathol. translation, tome ii. p. 490.

the larynx is that which has been designated polypus. These bodies are of various sizes and of a rounded figure; they appear to be formed by a morbid development of the cellular structure that enters into the composition of the sub-mucous tissue; they are completely invested with mucous membrane, and are attached by a pedicle generally to the ventricles of the larynx, or to one or both of the vocal cords. From the nature and the situation of their attachment to the laryngeal mucous membrane, they are usually found occupying that part of the larynx which lies above the rima glottidis; and when the polypus is large, or the pedicle of considerable length, the tumour may project into the pharynx over the lateral boundaries of the glottis.

The presence of polypus of the larynx is not indicated by any very characteristic signs, and consequently the disease is seldom discovered till after death. In a case mentioned by Albers, in the memoir before referred to, the patient, a man, aged 54, was subject from childhood to a dry cough, which never entirely left him. About three years before his death he was seized with violent hæmoptysis, and to this succeeded cough, purulent expectoration, loss of strength, and other signs of phthisis; he had also pain in the larynx, when pressure was made upon it, and when he attempted to speak: the respiration was hurried and difficult, the voice extinguished. These symptoms, which must undoubtedly have depended on an inflammatory affection of the larynx, were relieved by appropriate treatment, and a seton was then placed over the lower part of the larynx. In July, 1830, a few months after the last attack, all the symptoms returned, with the exception of the pain in the larynx; they continued nine months, but were ultimately removed: the patient then allowed the seton to heal. In July, 1831, he had a frequent cough, difficulty in breathing, and symptoms of threatened suffocation, with a feeling as though the trachea were stopped up by a plug (*bouchon*). In February, 1832, the symptoms returned with great intensity, and in addition there were difficulty in swallowing and pain near the left cornu of the os hyoides. The patient died in the month of March.

On dissection, a vomica was found in the upper lobe of the left lung, and tubercular granulations in the right lung. The larynx was very large, and on opening it a round fleshy tumour, of the size of a nut, was found lying between the inferior ligaments of the glottis and adherent by a root to each of the vocal cords. Immediately behind the tumour, between the ventricles, there was a cavity capable of receiving the polypus, and when it fell into this hollow it only obstructed the posterior half of the glottis. The mucous membrane enveloping the polypus was thickened and covered with minute ulcerations.

In a case mentioned by Dupuytren,¹ the patient, likewise an old man, suffered only occasionally from attacks of suffocation, which

¹ Lecons Orales, t. iii. p. 602.

were attributed to spasm of the glottis; the natural state of the respiratory function in the intervals doing away with the idea of there being any organic disease in the air passages. He died suffocated. On inspecting the body after death, a polypus, formed of cellular and vascular tissue, and covered by the mucous membrane, was found springing from one of the lips of the glottis: it was eighteen lines long and bifurcated at its loose extremity. This polypus generally floated in the cavity of the pharynx, and then produced no unpleasant effects; but as soon as, by a change of position, it got over the aperture of the glottis, it brought on the suffocative attacks, and in one more severe than the rest death took place. There are three cases of polypus of the larynx mentioned in Desault's *Ouvres Chirurgicales*.¹ In all of them the tumour was of a pyriform shape, and had its pedicle inserted into one of the ventricles of the larynx.

Mr. Herbert Mayo mentions having been favoured by Mr. Charles Mayo, of Winchester, "with a preparation from the body of an elderly lady, in which a firm, whitish, elastic polypus grew by a pedicle from the root of the epiglottis. It had produced occasional suffocative seizures, in one of which the patient died."² A preparation of the tumour is preserved in the anatomical museum of King's College. My friend Mr. Partridge, Professor of Anatomy in that Institution, has been kind enough to have a section made of the polypus, and to examine closely into the structure and attachments. It appears to consist of fat and cellular tissue enclosed in the laryngeal mucous membrane, which is reflected over it, and which entirely forms its pedicle; the fatty substance of the tumour does not enter into the composition of the pedicle, which is formed of the mucous membrane and cellular tissue only. The pedicle, the attachment of which could not be seen before the section of the tumour was made, arises from the left vocal cord.

In another case, a smaller polypus was found attached by a narrow pedicle to the left vocal cord. Of the history of this tumour very little is known: the larynx which contains it was taken, for the purposes of dissection, from the body of a young woman who died of phthisis; there was nothing particular observed about her previous to death, except that her voice was rather rough, though not remarkably so. The preparation is also in the anatomical museum of King's College.

Andral refers to two examples of polypus of the larynx that he had met with;³ in both, the subjects of the disease were patients affected with tubercular phthisis. One of them, besides having his voice nearly extinguished, had complained, during his residence in the hospital, of an habitual sense of uneasiness and constriction about the region of the larynx; the pedicle of the polypus was attached to one of the ventricles of the larynx.

¹ Par Bichat, t. ii. p. 254.

² Outlines of Human Pathology, p. 514.

³ Clinique Médicale, t. ii. p. 195.

The symptoms indicative of the existence of polypus in the larynx are too vague and undefined to enable us to lay down any positive rules of diagnosis. They appear to be an alteration or extinction of the voice; occasional attacks of dyspnœa with alarming suffocative seizures, in the intervals between which the respiration is perfectly free; a sense of uneasiness and of constriction about the laryngeal region, and slight difficulty of deglutition. In some of the cases, one only of these symptoms was present, in others all, or nearly all, of them were experienced in a greater or less degree: the most constant, however, were the occasional dyspnœa and the suffocative attacks.

When symptoms such as have just been described occur without any obvious cause, a careful examination of the back of the throat should be made, both by the sight and by the touch, and it is highly probable that a polypus of any considerable size, if such a lesion existed, would by these means be at once detected. In order to examine by the touch, the mouth should be propped open by some solid body placed between the molar teeth; the tongue being then brought forwards by means of a spoon, the index finger might be passed behind the epiglottis, sufficiently near the entrance of the larynx to enable us to ascertain the presence of a polypus.

With respect to the origin of these laryngeal polipi, it is more difficult to arrive at any satisfactory conclusions than with respect to their symptoms. In the case narrated by Albers, the disease appears to have been preceded by an inflammatory affection of the mucous membrane; in four of them at least, the patients were also the subjects of pulmonary phthisis, and therefore more than usually liable to inflammatory disease of the mucous membrane of the larynx; but whether this was merely an accidental coincidence the paucity of facts does not enable me to determine. Polypi in other situations are not generally considered to be the effect of inflammation, nor do those of the larynx exhibit any of the usual appearances to which this species of morbid action gives rise.

Treatment.—If it were possible to ascertain the existence of a polypus in the larynx during life, it would be the duty of the surgeon to attempt its removal by the knife or by a ligature round its base. For this purpose it would be necessary to divide the cricoid cartilage, and probably the thyroid also; but as the consequences of the polypus remaining are always mortal at some period or another, it would be right to give the patient this chance of relief from otherwise certain destruction. I am not aware of any case in which this operation has been undertaken.

Cartilaginous tumours.—In the *Dublin Journal* for September, 1835, an instance of a tumour of this kind is recorded.¹ A peasant, aged 38, was admitted into the Charité Hospital at Berlin, labouring under cough, copious expectoration, and emaciation, of

¹ The case was originally taken from the Berlin Medical Newspaper, September 17, 1834.

which he soon died. A firm osseo-cartilaginous tumour, nearly homogeneous in texture, was found connected with the right thyro-arytænoid ligament. It was of the size of a walnut, covered by mucous membrane in an unaltered condition, and pressed so much upon the rima glottidis as nearly to obliterate the passage for the admission of air. Mr. Macilwain met with a similar example.¹ He attempted to perform tracheotomy for the relief of the distressing dyspnœa which was caused by the presence of the tumour, but some unusual distribution of the arteries obliged him to desist, and the patient died suffocated. On inspecting the larynx after death, a firm cartilaginous tumour was found closing the glottis. A similar tumour was found outside the larynx and connected with the internal one, and also with the thyroid gland.

Other tumours, which probably were of the same character, have been occasionally described as scirrhus, though true scirrhus or carcinomatous affections of the larynx have seldom, or perhaps never, been found, except when the disease has been propagated from the pharynx or œsophagus. The scirrhus tumour that Pelletan² describes as attached to one of the lips of the glottis was, in all probability, either a polypous or a fibrous tumour.

Tumours of an anomalous kind have been found connected with the posterior part of the trachea, and by their pressure upon this tube and upon the œsophagus have produced great difficulty of breathing and of swallowing. Two instances of tumours of this kind are given by Morgagni;³ one, of the size of half a chesnut, was contained in the back of the trachea; the second, described as a large steatoma, was also found projecting into the same tube. In the *Medical Observations and Inquiries*⁴ we find an account of an asthma from an uncommon cause, by Dr. Rush of Philadelphia. The patient, a gentleman, aged 25, was seized with a succession of attacks of asthma, which at first came on in the evenings only, but afterwards never completely intermitted. He had an irregular pulse, and felt a sharp pain a little below the cricoid cartilage, on the left side of the trachea. He died, and on opening his body a tumour as large as a walnut, composed of a substance between flesh and cartilage, was found nearly an inch below the cricoid cartilage, seated partly on the trachea and partly on the œsophagus. It contained a tea-spoonful of dark-coloured fetid matter.

Dr. Baillie, in his work *On Morbid Anatomy*, speaks of having seen the trachea narrowed in its diameter for two or three inches, thickened in its substance, and having a number of little hard tubercles on its mucous membrane. The disease appeared to have spread from some absorbent glands in the neighbourhood, which were affected with scirrhus.

¹ Edinburgh Medical and Surgical Journal, vol. xxxv.

² Clinique Chirurg., tome i., p. 15.

³ Lib. ii., epist. xv.

⁴ Vol. v. p. 96.

Medullary sarcoma.—A tumour, having all the characters of this disease, has twice been found by Dr. Albers in the cavity of the larynx, and connected with the mucous membrane of the upper part of this organ.

Warty tumours, and other excrescences, have occasionally been found growing from the mucous membrane of the larynx: like the polypi before mentioned, they have never, I believe, been found in the trachea. "In Mr. Heaviside's museum, there is a preparation of the larynx of a child, on the mucous membrane of which, and also on the epiglottis, are numerous warts, resembling those so frequently observed on those parts of the body where the mucous membranes and skin unite."¹

Excrescences bearing some resemblance to a cauliflower have been found in the larynx. M. Rayer ascribes their origin to a syphilitic taint. He met with an instance of the kind in a woman fifty years of age: a cauliflower excrescence was attached near the upper edge of the left ventricle of the larynx, and expanded itself above the superior orifice of the glottis. It was attended during life by distressing dyspnœa, and a peculiar whistling sound of the air in respiration. M. Roux detected its existence during life by examination with the finger.² In plate xv. of the Atlas of M. Rayer's work is a drawing of a similar vegetation in a man. Andral³ met with an instance of the same disease, in which the superior aperture of the larynx was almost completely obstructed by a whitish cauliflower vegetation, which was continuous by a broad basis with the mucous membrane. He also mentions another specimen of the same kind, which M. Ferrus had exhibited to the Académie Royale de Médecine. Andral considers these bodies to be merely certain forms of circumscribed hypertrophy of the mucous membrane. In the paper by Albers, to which allusion has been made before, is an account of a warty tumour in the larynx for the relief of which laryngotomy was performed. The thyroid cartilage was divided from top to bottom, and the larynx was found full of warty excrescences. They were cauterised with the nitrate of mercury and afterwards with a hot iron, but they still continued to grow: and although, at the time of writing, the patient was living, there remained in the mind of the medical attendant no doubt as to the fatal issue of the disease.

¹ Baillie, *Morbid Anatomy*, v. ii. p. 84.

² Rayer, *On Diseases of the Skin*, translation. p. 825.

³ *Pathological Anatomy*, translation, vol. ii. p. 472.

INJURIES OF THE LARYNX AND TRACHEA.

CHAPTER XV.

WOUNDS OF THE LARYNX AND TRACHEA.

The fatal result that so frequently follows these accidents depends, in general, far more upon the complications with which they are attended than upon the nature of the lesion itself, as it affects the air tubes merely. A simple incised wound of the trachea, unaccompanied by serious injury of the surrounding parts, presents no great difficulty, and excites very little more apprehension than a similar wound in other regions, provided that all hæmorrhage has ceased or can be easily controlled. The most simple applications externally, and the maintenance of perfect quiet and of such a posture of the head as shall approximate as nearly as possible the lips of the wound, are generally all the measures necessary for securing a complete and speedy cure. Wounds of the larynx, those especially that penetrate the thyroid cartilage, are more dangerous, from the proximity of the mischief to the vocal cords and the lips of the glottis, which may be involved to such an extent in the inflammation that occurs subsequent to the injury as to put a stop to respiration.

It will be convenient, in considering the subject of wounds of the larynx and trachea, to divide them, 1st, Into those which interest that part of the larynx situated above the attachment of the vocal cords to the thyroid cartilage; and 2d, Into those which penetrate the cavity of the larynx or trachea. Wounds in the former situation are comparatively free from danger, because, unless very deep, they do not reach the track through which the air passes in respiration, and therefore the risk from hæmorrhage into the trachea is, in most instances, absent. The effusion of blood into the air tubes is the most immediately dangerous circumstance connected with wounds of the larynx or trachea, and life is much more frequently lost by this occurrence than by external bleeding; for in the attempts of suicides, which furnish by far the largest proportion of these cases, the carotid artery and its principal branches are seldom divided. The person bent on destroying himself probably deems a division of the windpipe sufficient to ensure the end; and to bring this organ prominently forward, and at the

same time to render the front of the neck tense, he throws his head back, by which action the common carotid artery, its larger branches, and the internal jugular veins, are ordinarily placed out of the reach of the knife. An individual strongly bent on suicide, and possessed of considerable muscular power, can still manage to attain the blood vessels; and on this subject Pelletan remarks, that "the unfortunates that cut their throats and are carried to the Hôtel Dieu, are either young persons, whom love or the passion for play have led to this excess of despair, or old men, who are driven to it by their misery and the extent of their privations. The former seldom fail; they make long and deep wounds, which give rise to hemorrhage either mortal in itself or by the passage of the blood into the bronchi."¹ When the immediate danger from bleeding into the windpipe has past away, secondary hemorrhage may occur either on the establishment of reaction, or from the effects of ulceration; and this is more likely to be attended with fatal results when the edges of the wound have been brought together, and no outlet is left for the escape of the blood. Pelletan records a case in which hemorrhage into the trachea occurred with mortal effect on the establishment of reaction.² A man was found, in the middle of the night, in one of the wards of the Hôtel Dieu, with a long and deep transverse wound of the throat, from which a large quantity of blood had been lost. He was greatly reduced by the bleeding, but restoratives were administered and the wound was dressed. On coming to himself, the first use he made of his returning powers was to tear off the bandages, and some minutes afterwards he was found dead. The dissection of the parts showed that the blood had been furnished by the left external jugular vein, and that it had fallen into the trachea and produced suffocation. In Mr. Wood's paper, "On Diseases of the Larynx,"³ there is a case taken from the twenty-eighth volume of Rust's Magazine. A girl had her throat cut, and lost a large quantity of blood from the right external jugular vein. The wound extended across the neck, completely dividing the thyroid cartilage and penetrating the gullet. The bleeding vein was tied, and the wounds in the thyroid and in the integuments were separately and closely united by sutures; air no longer escaped, and the voice returned. About eight hours after the infliction of the wound there was great restlessness, with difficulty of breathing, a full pulse and hot skin, and in an hour afterwards death took place. On inspecting the body, no vessel, except the right jugular vein, which had been tied, was found to be injured, but the windpipe was filled with frothy blood, which had passed far down into the bronchial tubes. In Wilmer's Observations in Surgery⁴ is an instance of death occurring in a man from

¹ Clinique Chirurg. tome i. p. 32.

² Lib. cit., p. 33.

³ Medico-Chirurgical Transactions, vol. xvii.

⁴ Page 92.

the same circumstance, five days after he had cut his throat: in this case the wound had penetrated the crico-thyroid membrane, and its edges had been closely united by sutures. Death took place suddenly from hemorrhage into the trachea. Many other instances illustrative of this point might be cited, but they would only encumber the subject without throwing upon it any additional light.

To the consideration of the baneful effect of sutures and tight bandages upon wounds penetrating the air tube, I shall return in another part of this chapter.

I. WOUNDS OF THAT PART OF THE THROAT SITUATED BETWEEN THE OS HYOIDES AND THE THYROID CARTILAGE.

Wounds in this situation may injure the epiglottis, the anterior wall of the pharynx, or the lips of the glottis and the arytaenoid cartilages. The probability of any one of these parts being implicated in the incision may be judged of in a great measure by the situation, the direction, and the depth of the wound; and in proportion to the proximity of the incision to the upper margin of the thyroid cartilage is the danger augmented.

The epiglottis is not often injured by the suicide; the mobility of this organ, and its position being in a direction somewhat parallel to the line of incision, generally save it from injury. It may, however, be severed from its connections with the tongue and os hyoides by a division of the hyo-thyroid membrane; or it may be separated from the thyroid cartilage, and yet its anterior superior attachments continue unaffected. Of the former accident an instance is mentioned by Dr. Houston,¹ which, from some curious results connected with it, is worthy of being transcribed:—

“In March, 1828, a servant, out of place, during a fit of delirium brought on by intoxication, attempted to destroy himself by cutting his throat with a razor. I saw him in about ten minutes after, and found him almost lifeless; the pulsations of the heart were imperceptible, the pulse at the wrist had ceased to beat, the limbs were cold, and all feeling and consciousness lost. The razor had entered between the os hyoides and the thyroid cartilage, and disunited them so completely as to allow the former to ascend with the tongue into the mouth. The pharynx was laid wide open, and the epiglottis severed from its attachments to the tongue and os hyoides, and left hanging by its pedicle to the back of the *pomum adami*. The carotids had escaped untouched, and the bleeding was inconsiderable. It appeared difficult at the moment to account for the sudden extinction of life; the symptoms were evidently those of suffocation, but the cause was not at first understood. I passed my finger into the wound, and found to my surprise, that the epiglottis,

¹ Dublin Hospital Reports, vol. v. p. 315.

loosened from its upper and lateral attachments, had fallen back over the rima glottidis, and completely intercepted the passage of air to the lungs. I raised the obstructing body and drew it forwards: the chest soon began to heave, respiration returned, the heart and pulse again beat, and consciousness and sensibility were re-established.

"It required some effort of my fingers to hold up the epiglottis, as the air at every inspiration tended to force it back again to its unnatural and dangerous position. * * * The top of the epiglottis was brought over the edge of the thyroid cartilage, and secured to its anterior surface by a single stitch. The man in a short time sat up and attempted to speak, but was unable to articulate." He died in about a week after of erysipelatous inflammation of the neck and throat.

The details of this case bring to our notice a fact of great practical importance, in the near approach to suffocation produced by the falling of the epiglottis over the rima glottidis, and the facility with which the immediate danger arising from it may be averted. In the case of the separation of the epiglottis from the thyroid cartilage, no particular symptoms are likely to present themselves, except it be carried by the action of the muscles attached to the os hyoides far from the orifice of the larynx, when a troublesome convulsive cough, and other signs of irritation of the glottis, might be anticipated on making the attempt to swallow food.

CASE.¹

A man, forty-seven years of age, made a deep wound in the upper part of the neck, between the thyroid cartilage and the os hyoides, detaching the former almost completely from the latter, and making an aperture half an inch in width. When the patient was placed in bed, with his head brought forward by pillows, the great gash in the throat was closed, and the patient could speak and swallow perfectly well. At the end of a week the wound had healed, but on the supervention of erysipelas of the arm the recent adhesion gave way, and the wound gaped as widely as at first. Fluids attempted to be swallowed now escaped through the aperture. The patient died in a fortnight from the time of his admission; and on examining the body a large transverse opening was found between the epiglottis and glottis, neither of these being injured.

In this case no particular results followed from the separation, by the knife, of the epiglottis from the glottis as long as the edges of the wound were kept in apposition; deglutition was effected with perfect facility. When, from the occurrence of erysipelas, the wound afterwards re-opened, fluids passed freely through it.

Painful cough, difficult and painful deglutition, and other signs

¹ Lancet, vol. xii. p. 669.

of irritation of the glottis, are always observable for some time after the epiglottis, or a large portion of it, has been carried away or destroyed.

CASE.¹

General Murat, afterwards King of Naples, was wounded at the battle of Aboukir by a musket ball, which traversed the great diameter of the neck from one angle of the jaw to the other. One of the first phenomena that B. Larrey observed, when called to him, was the expectoration of the loose floating half of the epiglottis, which was accomplished after many efforts and many suffocative seizures. For some days afterwards, the general was tormented by an obstinate and painful cough, and deprived of voice and of all power of pronounciation, being only able to make himself understood by signs or by writing.

The wounds made by the entrance and exit of the ball were closed by appropriate bandages, and an elastic tube of large size was passed into the œsophagus, through which liquid nourishment and refreshing drinks were conveyed to the stomach. The patient went about as usual, and experienced no other inconveniencies than those arising from his inability to speak, and to swallow without the aid of the œsophageal tube.

After the 19th day, the epiglottis, which had probably undergone some modifications of form, in concert with an increased development of the arytaenoid cartilages, again fulfilled its office of protecting the larynx, and the patient was able to swallow solid nutriment with ease, first taking the precaution of rolling the softened food into a kind of bolus. For some weeks he was obliged to adhere to this manner of taking sustenance; the voice and speech became gradually re-established, but without ever gaining their original strength.

In the foregoing case the loss of half the epiglottis took away the power of deglutition for nearly three weeks, and at the end of this time solid viands only could be swallowed. In a second case of a similar nature the results were more severe, for the entire epiglottis was cut off by a bullet and afterwards spit out.² The entrance of the larynx being thus exposed, no liquid of any kind could be swallowed without inducing a convulsive and suffocating cough; and in consequence of the heat of the climate (Egypt), and the irritation of the wound, the poor patient was horribly tormented with thirst, which he had no means of relieving. This state continued some days before M. Larrey saw him. He immediately passed a tube into the œsophagus, and administered drinks of a refreshing nature, and some broth. The passing of the tube was not always executed with the same facility in this instance as in the case of General Murat, for the tube often went into the larynx instead of

¹ Larrey, *Clinique Chirug.* t. ii. p. 142.

² *Relation Chirug. de l'Armée d'Orient*, p. 286.

into the œsophagus. When this happened the mistake was not discovered by any particular sensation about the glottis, but immediately after the first drops of liquid had passed the lower end of the tube, the patient was seized with a suffocating cough, which seemed to endanger his life. According to M. Larrey's experience, the best mode of ascertaining if the tube had taken the right direction was to pass one or two drops of fluid along it, and, if any uneasiness or cough was occasioned, immediately to withdraw the instrument, and change its direction till it found its way into the œsophagus. The man's life was saved by these means; the wounds cicatrised rapidly, but the difficulty of swallowing always remained, and the power of speech was only regained after a considerable lapse of time, and then in a very incomplete manner. This patient, like the last, could swallow with greater ease if the food was rolled into balls or boluses, and M. Larrey, in placing him in the *Corps des Invalides*, gave him a special certificate, in order that he might always be fed in this peculiar way.

We have to remark, in these two interesting cases, 1st. That the destruction of the epiglottis seriously injures the voice; 2d. That, immediately after its occurrence, the power of swallowing is lost, but that, in time, the lips of the glottis are able to prevent solid food from penetrating into the larynx, though liquids will still produce much inconvenience; and 3d. That an elastic sound introduced into the larynx does not give rise to any peculiar sensations that will indicate the occurrence with any degree of certainty. With regard to the treatment of these cases no observations are necessary, except that, in order to ascertain if the tube were in the larynx, some less severe mode might have been adopted than the passing of a few drops of fluid, as the convulsive cough that occurred when the tube was in the glottis must have produced great pain in the wounded parts bordering upon this organ. A lighted candle placed at the external orifice of the tube, though not an absolutely certain mode of determining the point, should at least have been tried, as, in the event of no agitation being occasioned by the breath, the injection of the liquid through the tube might still have been commenced with the same precautions, and, it is probable, much suffering would have been saved the patient.

Wounds made in the space between the os hyoides and the thyroid cartilage may prove fatal by exciting inflammation of the glottis, and consequently serous infiltration of the sub-mucous tissue of the epiglottis and superior aperture of the larynx.

CASE.¹

A workman cut his throat with a razor between the os hyoides and thyroid cartilage, and was conveyed to the Hospital at Toulon four hours after the accident. The lips of the wound were brought

¹ Medico Chirurgical Transactions, vol. xvii. p. 198.

together by adhesive straps, a compress was applied, and the head inclined towards the chest. The next day the pulse was excited; blood was taken from the arm, and soothing drinks were prescribed. On the 5th day, alarming symptoms suddenly appeared; fits of imminent suffocation, agitation, heat of skin, tumefaction of the neck, complete loss of voice, hissing and very laborious inspiration, and less difficult expiration. The patient was largely bled from the arm, leeches were applied to the neck, and sinapisms to the feet, but the paroxysms increased, and the patient died in the evening.

Dissection.—There was considerable ecchymosis of the fold of membrane which unites the epiglottis to the right arytaenoid cartilage. The mucous membrane of the epiglottis, and of the upper part of the larynx and its ventricles, was œdematous. The upper margin of the thyroid cartilage and the hyo-thyroid membrane had been divided by the original wound.

A second case, very similar to the one just transcribed, except that death occurred in a few hours after the accident, is to be found at page 200 of the same volume:

A Swiss soldier made a wound in his throat about two inches long, at the upper border of the thyroid cartilage. The edges of the incision were brought together by strips of adhesive plaster, and the patient was directed to keep his head forwards. After the lapse of five hours, the breathing became very difficult, the face injected, and suffocation menaced. As the bandages seemed too tight, an ordinary chin cloth was substituted, and the man felt relieved. However, he continued restless and agitated, the difficulty of breathing soon increased, and he died six or seven hours after his entry into the hospital.

Dissection.—The course of the wound and all the anterior cervical region were infiltrated with blood, which had come principally from the laryngeal branch of the right superior thyroid artery. There was considerable œdema of the membrane investing the arytaenoid cartilages, and the chink of the glottis was nearly obliterated by the swelling. The cerebral veins were more distended than natural, and the lungs were congested.

Remarks.—In both these cases, death occurred from the effects of acute laryngitis, with serous infiltration of the sub-mucous tissue of the lips of the glottis; and there cannot be the slightest doubt, but that the early performance of tracheotomy would have obviated the danger. When the larynx becomes inflamed and obstructed, the existence of a wound in a situation above the aperture of this organ, should not deter us from the adoption of the operation; the introduction of a tube into the glottis by way of the nostril, as recommended by Desault, is quite inapplicable to the relief of acute laryngitis; nor is there any other remedial measure upon which the smallest reliance can be placed, compared with the division of the trachea. If the original wound were in the windpipe, or in the

larynx below the level of the vocal cords, it might be advisable to introduce a canula or an elastic tube through the wound into the air tube, in case of symptoms of obstructed respiration or suffocation arising; but in instances similar to those just related, tracheotomy only could give relief.

If the knife of the suicide penetrate deeply into the hyo-thyroid space, the anterior wall of the pharynx will be opened; the occurrence of this accident will soon declare itself by the passage of liquids, taken by the mouth, through the external wound. If the opening into the pharynx be of small size, no particular plan of treatment will be required; such a position of the head and neck as shall approximate the edges of the wound, will often be sufficient to prevent any food from escaping externally. "Walther relates an instance of attempted suicide, in which the membrana thyreo-hyoidea, was divided with a razor. The larynx was depressed, and all nourishment escaped through the wound. The patient at length found a means of placing his head, which enabled him to take food. He got well rapidly without the aid of sutures or plasters."¹

The continual escape of alimentary matters through the wound must be a source of extreme inconvenience and of delay in the progress towards recovery; on which account, if the opening through the parietes of the pharynx is large, or if deglutition is attended with difficulty and distress, an elastic tube must be introduced into the œsophagus, either from the mouth or from the nostril, and food must be injected through it into the stomach. The use of the œsophageal tube has also this advantage, that it prevents the separation of the lips of the wound, which always happens during the act of swallowing.

A wound of the upper part of the thyroid cartilage may implicate the arytaenoid cartilages or the vocal cords, in either of which cases the danger of œdematous inflammation of the larynx will be very considerable. Sir Charles Bell, in his *Surgical Observations*,² mentions the instance of a man who had cut his throat, and who suffered at times from difficulty of breathing, and then a flapping of something in the throat could be heard. He died; and it was discovered that the knife had divided one of the arytaenoid cartilages, and that the portion hung by the membrane so as to vibrate in the chink of the glottis, like a pea in a cat-call, and, acting as a foreign body caught in the rima glottidis, it occasioned suffocation.

In the same page he likewise mentions a wound of the junction of the vocal cords. A young woman plunged a penknife into her throat. The point of the knife pierced the upper part of the thyroid cartilage, so that it entered at the union of the cordæ vocales.

She was suffocated, at the distance of some months, by the granulations which arose from the edge of the wound, and which filled up the passage of the glottis.

¹ Mr. Wood, *Medico-Chirurgical Transactions*, vol xvii. p. 223.

² Vol. i. p. 44.

These cases are perhaps more curious than instructive; but the practical lesson they tend most strongly to impress upon us is the advantage of performing tracheotomy where obstruction to respiration exists, even if the cause cannot be satisfactorily made out. There can be little doubt that the first of these cases would have been relieved by the operation, and in all probability the second also; and time would have been gained for the employment of the measures necessary to complete the cure.

II. WOUNDS PENETRATING THE CAVITY OF THE LARYNX OR TRACHEA.

A very obvious distinction is observable between those wounds of the throat that penetrate into the cavity of the air tube, and those which interest only the parts superior to the rima glottidis. In the former class, we cannot have obstructed respiration, as long as the external wound remains open; whilst, in the latter, we have seen that death may be occasioned by this circumstance in a few hours after the receipt of the injury. At the same time, there can be no doubt that wounds which penetrate any part of the air tube—whether the laryngeal or tracheal portion of it, are attended with much greater risk to life than those which merely injure the epiglottis, the anterior wall of the pharynx, or the hyo-thyroid membrane. In injuries of the former description death may result from hemorrhage into the trachea; from suffocation, caused by excessive granulations springing from the wounded mucous surface; from extension of the inflammation round the wound to the lungs and pleuræ; and from general emphysema.

The frequency with which death ensues from hemorrhage into the trachea, after a wound of this organ or of the larynx, has been already mentioned. When the wound of the throat is rather high up, the blood is commonly derived from the lingual or superior thyroid arteries; when the trachea is divided, the external jugular veins are a very frequent source of the blood—as happened in the cases taken from Pelletan and Mr. Wood's paper, which have been already referred to, and also in a case mentioned by Mr. Samuel Cooper in his lectures.¹

When the immediate ill consequences of a wound in the larynx or trachea have passed away, when the incision has completely healed, and respiration by the natural passage is again established, excessive granulations, or a chronic thickening of the mucous membrane of the air tube in the neighbourhood of the part that had been injured, will sometimes entirely obstruct the passage of the air, and cause death by suffocation. An instance of this kind is mentioned by Sir Charles Bell in his *Surgical Observations*.² "A young woman, resolving to destroy herself, pushed a penknife into

¹ Ryan's Medical and Surgical Journal, vol. v. p. 580

² Vol. i. p. 45.

the fore part of her throat and drew it downwards, cutting through five of the rings of the trachea. She survived the first effects of this wound, but was suffocated by the retraction of the cut edges of the cartilages and the swelling of the inner membrane, which thereby diminished the capacity of the tube." Pelletan also mentions a case in which death is attributable to the same cause, though the time of its occurrence was hastened by mental agitation.¹ A young Savoyard was brought to the Hôtel Dieu with his throat cut. The wound, which had been inflicted by a comrade, had divided the trachea just below the cricoid cartilage, and opened the œsophagus. The food at first came through the wound, but ceased to do so by the 15th day, and at the end of six weeks the external incision was cicatrised. The patient, though cured, had not yet left his bed, when one of the police came to confront him with his assassin. He got up with promptitude and emotion, and fell dead at three paces from the bed. The opening of the body showed a remarkable contraction, with thickening of the mucous membrane, of the trachea opposite the cicatrix of the wound. In the *Medico-Chirurgical Review* for July, 1831,² a very remarkable case, illustrative of the same effects, is related. The original wound divided the trachea at its upper part, and when it was nearly healed, the breathing became so difficult that the patient, of his own accord, pushed a knife through the cicatrix. The wound again nearly healed, and the dyspnœa returned. The patient therefore introduced a leaden tube into the trachea, and wore it for six years, at the end of which time he died of phthisis, after experiencing repeated attacks of bronchitis. The obliteration of the air passage was found, upon dissection, to be complete where the trachea joins the larynx. Other instances of death from suffocation, caused by tumefaction of the lining membrane of the trachea and larynx, may be found in Mr. Wood's paper "On Wounds of the Throat," and in Wilmer's *Observations in Surgery*.

With respect to the nature of these granulations of flesh,³ "gonflement de la membrane muqueuse,"⁴ "fleshy swelling,"⁵ &c. we are left, by the narrators of the cases, very much to our own conjectures; but, in all probability, these obstructions of the air tube are the effects of chronic inflammation, which is kept up by the wound in the sides of the tube. An increase in the thickness of the mucous membrane itself, and more especially of the sub-mucous cellular tissue, is a general result of long-continued irritation of these surfaces; familiar examples of which may be found in the state of the conjunctiva when the eye-lashes are habitually inverted; in the hypertrophied condition of the lining membrane of the bladder when a calculus has been long resident in this organ; and in the thickened state of those parts of the rectum or urethra that border upon a stricture in either of these passages.

¹ Lib. cit. p. 38. ² Page 238. ³ Wilmer. ⁴ Pelletan. ⁵ Wood.

The fact, that death may occur from obstructed respiration even after the healing of the wound of the trachea, is fully established by the cases that have been mentioned, and it should induce us to be upon our guard, and to view with a most suspicious eye every symptoms of dyspnœa or menaced suffocation that may arise for some time after the healing of the external incision.

Inflammation may extend downwards from the external wound to the bronchial ramifications, the lungs, or the pleuræ; and this may happen when the division of the windpipe has been very trifling in extent.

CASE.¹

A woman, aged 50, wishing to destroy herself, cut the anterior part of the throat with a knife, making a small transverse incision into the trachea, just below the larynx. She was not brought to the Hôtel Dieu till three days after committing the act. The neighbourhood of the wound was emphysematous, respiration was impeded, there was cough, alteration of the voice, and general fever. The wound was enlarged and the patient was bled, but the symptoms became aggravated during the night, and she died on the following day (the fifth of the wound.)

The opening of the body showed two small wounds in the trachea, inflammation of its mucous membrane, and some lymph upon its interior. Both pleuræ were acutely inflamed, with effusion of serum and albuminous concretions into their cavities.

CASE.²

Ann Halley, a woman about the middle age, was brought into the Westminster Hospital with a self-inflicted wound in the throat, which had divided the cricoid cartilage and penetrated the larynx. For a few days the patient appeared to be doing well: the symptoms, however, changed; those indicating pneumonia made their appearance, and, in spite of the usual remedies, she died. On examination of the body, there was found effusion of bloody serum into the right pleural cavity, indications of pleuritis on both sides, and some marks of pneumonia, but not so intense as the inflammation of the pleura.

In a case related by Dr. Cullen,³ the patient (likewise a woman), after cutting her throat and opening the lower part of the larynx, fell a victim to the extension of the inflammation from the wound down the trachea to the bronchial ramifications. She died in a few

¹ Pelletan, lib. cit., p. 47.

² Ryan's Medical and Surgical Journal, vol. vi. p. 799.

³ Edinburgh Medical and Surgical Journal, vol. xxix.

days after committing the act, from accumulation of mucus in the bronchiæ, and consequent suffocation.

Wounds of the larynx may prove fatal by causing emphysema of the body to such an extent as to impede respiration, but this must be always owing to a faulty or inattentive mode of dressing or bandaging the wound, or to the injudicious use of sutures. If, however, the larynx be crushed or ruptured without the skin giving way, emphysema is a certain result, and, if it be not actively treated, may destroy the life of the patient. The only instance of this kind of injury that I have met with is a case by Dr. O'Brien, in the eighteenth volume of the *Edinburgh Medical and Surgical Journal*.

A woman was brought into the Royal Infirmary of Edinburgh on the evening of the 23d of July, 1818. The face was tumid, lips livid, breathing very laborious and stridulous. The skin was cold, and that of the thorax, neck, face, and superior extremities, distinctly emphysematous; and the pulse was scarcely perceptible. She pointed to the throat as the chief seat of pain, and said she had been kicked under the jaw; on the lower anterior part of the neck was a bluish mark. Scarifications were made about the lower part of the neck, and restoratives and opiates were administered internally. On the following morning her breathing had become more difficult, and she expired about nine o'clock.

Dissection.—The cellular substance of the neck was every where distended with air. On the soft parts being removed, a rupture was found through the whole depth of the thyroid and cricoid cartilages, on the left of their mesial plane, and then through the right side of the first ring of the trachea. The ruptured edges of the cartilages were rather tumefied, and slightly inverted. Most of the cellular substance surrounding the larynx, pharynx, and trachea, was emphysematous. The anterior mediastinum was also emphysematous. On opening the heart, the blood was found not coagulable and quite frothy from the admixture of air, and that in the aorta and vena cava abdominalis was in the same state.

Wounds in the larynx and trachea may be complicated by a simultaneous division of the pharynx or œsophagus, or by a wound in their anterior parietes. This occurrence has already been noticed in many of the cases that have been detailed. Upon the whole, the pharynx is much less seldom wounded than the œsophagus, because it is so completely protected by the larynx, and can only be laid open by a cut that shall divide the thyroid or cricoid cartilages, or, in some situations, both of them. When the trachea is completely cut across, the œsophagus is generally injured, and sometimes divided through the whole of its circumference.

The escape of fluids taken by the mouth, through an external wound in the larynx or trachea, is by no means a certain proof that the pharynx or œsophagus is injured. Mr. Pretty has detailed

some particulars of a case of fatal wound of the larynx, where the patient, a few hours after the infliction of the wound which severed the thyroid cartilage into three pieces, attempted to swallow some milk and water; a suffocative cough was instantly produced, great part of the fluid was returned by the mouth, and some passed through the wound. The same thing was noticed in two or three subsequent attempts at swallowing. This patient died in about two days, and on a post mortem inspection no breach of structure could be discovered in the pharynx or œsophagus.¹ In another case narrated in the *Lancet*,² the escape of fluids through a wound in the larynx led to the supposition that the œsophagus was injured; but after the death of the patient, which occurred on the eighth day of the accident, no wound was discoverable in the œsophagus. A similar occurrence took place, a few days ago, after the operation of tracheotomy performed in the last stage of croup. Some milk was given to the little patient, part of which was swallowed and part was ejected through the opening in the trachea. The dissection of the parts after death showed the œsophagus to have been entire and uninjured, but the epiglottis and the lips of the glottis were thickened, and coated with a dense layer of lymph.

The escape of the fluid externally is, perhaps, to be accounted for by the defective action of the epiglottis, in consequence of injury done either to its structure or attachments, or to the nerves from which it derives its sensibility or motive power.

If the laryngeal cartilages are completely divided by the knife in a transverse direction, the upper portion of them is drawn upwards by the muscles which pass from the jaw to the os hyoides; and the inferior portion is drawn downwards by the sterno-thyroid muscles, and by the contraction of the trachea; but such a wound as this is seldom seen. "When the trachea is divided through a part of its circumference only, the edges of the wound separate but little from each other; they may easily be placed in contact by the flexion of the head upon the neck. But when the trachea is entirely cut through, the two ends separate from one another; the inferior one conceals itself under the neighbouring parts, and is no more in a condition to receive the air; so that, respiration no longer taking place, or being performed with extreme difficulty, the patient soon perishes, as is proved by numerous observations."³

When to a transverse division of the larynx or trachea is super-added a complete section of the œsophagus, the case becomes one of great difficulty and danger. Retraction of the inferior portions of both canals takes place to such an extent that they are with difficulty discovered; the loose skin at the lower margin of the wound is drawn with each attempt at inspiration over the mouth of the trachea, and suffocation is the almost inevitable result.

¹ *Lancet*, vol. xii. p. 654.

² Vol. xii. p. 574.

³ Boyer, *Traite des Maladies Chirurgicales*, tome vii. p. 22.

Cases of this kind have, however, sometimes terminated favourably, and with a complete restoration of the functions both of the trachea and œsophagus. In other instances the cure has been less complete, as, for example, in a case related by Dr. Gairdner:¹

The subject of this observation cut his throat with a razor, dividing the larynx at the upper part of the cricoid cartilage, and the œsophagus also. The cut extremities receded from each other to the distance of at least three inches. Attempts were made to unite the divided larynx by means of sutures, and to pass a gum-elastic tube from the nostril into the œsophagus, but without success. Ultimately the man recovered, though with an aperture in the front of the neck, through which respiration was performed, and through which liquid nourishment was conveyed into the stomach by means of an elastic tube introduced, at each meal, into the lower portion of the œsophagus. Two years after the infliction of the wound, he was strong and fat, and had all the appearance of a person enjoying excellent health.

Prognosis.—The prognosis in wounds of the larynx and trachea, especially when inflicted for the purpose of self-destruction, is almost always unfavourable. Independent of the nature of the injury, which is in itself very serious, the mental condition of the patient, which has induced him to commit the rash act, and which, in all probability, will still remain unaltered, is a powerful bar to his recovery. Instead of an anxious desire for restoration to health, a willingness to submit to treatment, or to make sacrifices for the promotion of such an end, the patient, in the majority of instances, remains in a state of deep despondency, or tries every means in his power to frustrate the curative efforts of his medical attendant. Putting out of consideration the state of the mind, there is nothing in the structure or functions of the air passages to render wounds of them so dangerous as they generally prove. When uncomplicated with serious hæmorrhage, or with a division of the pharynx or œsophagus, we should be inclined to think that the chances of recovery in these cases were greatly in favour of the patient, had not universal experience shown that the reverse most frequently happens. To what, then, can the generally fatal result be attributed but to the influence of the mental disorder, which medicine has no power of alleviating?

Persons advanced in years recover less frequently than those who are younger. They are thin and emaciated; the skin rolling, as it were, under the knife, is cut irregularly, and its incision seldom corresponds with that of the windpipe. When the head is brought towards the breast, the edges of the wound become inverted first, and afterwards gangrenous, and the patients perish about the twelfth or fifteenth day.²

Independent of the state of mind and the age of the patient, the

¹ Edinburgh Medical and Surgical Journal, vol. xvi. p. 353.

² Pelletan, lib. cit. p. 40.

prognosis will be more unfavourable in proportion to the extent of the wound of the trachea and the complications with which it may be attended; such as injuries of the œsophagus, and of the vessels and nerves of the neck. "It is very well known that, in most instances of suicide, the patient perishes rather from lying a long time undiscovered, and the want of instant assistance, than from the importance of the blood-vessels or other parts included in the injury."¹ This circumstance, therefore, must be taken into account when forming an opinion of the probability of recovery from a serious wound in the larynx or trachea.

Treatment.—The nature of the means to be employed for the cure of wounds in the throat must depend very much upon the situation of the injury, its extent, and the complications with which it is attended. Under all circumstances, however, the first indication in the treatment of these accidents is to arrest the flow of blood by tying the divided vessels, whether arteries or veins, when they are capable of being seized. It is very unwise to attempt the closure of a wound communicating with any part of the respiratory track before this preliminary step has been attended to; for if bleeding goes on, the blood, prevented from making its escape externally by sutures or bandages, must necessarily find its way into the pharynx or the trachea: in the former case it will produce extreme inconvenience; in the latter, it will probably cause death by suffocation. As long, therefore, as any hæmorrhage continues, the external wound must be kept open; when we are satisfied of the patient's safety with respect to bleeding, we may proceed to the closing of the wound, which is to be effected by position, by sutures, by plasters and bandages, or by a union of some or all of these.

Wounds in the hyo-thyroid space, whatever may be their depth, may generally be kept closed by position alone. Formerly sutures were always employed, but, experience having fully demonstrated their inutility, they have been abandoned. The proper position for bringing and maintaining in contact the edges of a wound in this situation is one in which the chin is brought towards the chest: this is to be effected by means of a bandage, formed of strips of linen, attached to each side of the hinder part of a strong night-cap to be worn by the patient; the lower ends of these strips must be fastened to a band passing round the chest and under the arms. The position of the head may be regulated, according to circumstances, by tightening or slackening the strips which pass from the head to the chest; and the effect of the bandage may be assisted by placing the patient on his back in bed, with high pillows under the head. Plasters of an adhesive kind are sometimes useful in maintaining the edges of the divided integuments in contact.

If the wound in the hyo-thyroid space penetrate so deeply as to lay open the pharynx, the greatest distress may be occasioned to

¹ Porter, lib. cit. p. 231.

the patient; the passage of the air through the wound, and the constant flow of saliva and mucus from the back of the mouth, which take place in spite of the bandages, render the fauces dry, and excite a continual and unquenchable thirst. In this state of things it is quite necessary that the patient lie upon his back, and thus a part of these accidents will be prevented. A tube must be passed from the mouth or nostril into the œsophagus, through which liquid nourishment may be injected into the stomach. In a former part of this chapter, I have stated that persons with an anterior wound in the pharynx can often swallow tolerably well by leaning the head forwards and a little to one side; but every movement of deglutition must tend to separate the edges of the wound, and prevent their healing; and on this account it is very desirable that all nourishment should be taken through the œsophageal tube till the communication of the pharynx with the external wound has firmly closed. If the frequent introductions of the tube into the œsophagus are attended with great pain and inconvenience, injection, *per anum*, of strong broths and jellies may be occasionally substituted with advantage, and the thirst may be allayed by the use of warm baths. Dr. Hennen narrates an interesting case of wound of the larynx and œsophagus, the subject of which was supported by these means for several days.

CASE.¹

A Malay had his throat cut by a comrade; the wound completely severed the larynx between the thyroid and cricoid cartilages, and half divided the œsophagus. As the attempt to close the wound caused feelings of suffocation, it was left open, and the patient breathed entirely through it; but his greatest suffering proceeded from thirst, as every thing he tried to swallow came through the opening. The surgeon attempted to introduce liquids through a flexible tube, but succeeded very badly, on account of the great irritability of the fauces, trachea, and œsophagus. As there was an abundance of milk to be had, the patient was put into a bath of this fluid several times in the day, and clysters of various nutritious liquids were assiduously thrown up. By these means he was entirely supported during the space of eighteen days, and nothing but common dressings were applied to the wound. At the end of this period the œsophagus became retentive when liquids were taken, and he rapidly recovered.

If difficulty of breathing should come on within a few days after the infliction of a wound in the hyo-thyroid space, if the inspirations, more particularly, should become very laborious, there would be reason to believe that inflammation had extended from the injured parts to the lips of the glottis, and the most active anti-

¹ Principles of Military Surgery, second edition, p. 363.

phlogistic measures would be required to subdue it. Nor would it be right to trust entirely to these, however strenuously they might be employed, unless considerable benefit speedily accrued from their use; but bronchotomy, as the only certain means of removing the obstruction to respiration, must be had recourse to.

It is in cases of this description that Desault has recommended the introduction of elastic tubes through the nostril into the larynx: of the advantages and disadvantages of this practice I shall treat in a future chapter, when speaking of the operation of *bronchotomy*.

Wounds penetrating into the cavity of the larynx require a very similar mode of treatment to those in the hyo-thyroid space. If the incision has not completely severed the laryngeal cartilages nor wounded the pharynx, a strict attention to the position of the head, so as to keep the lips of the wound in contact, and the application of adhesive plaster, supported by a bandage, are all the external means necessary to be adopted. But when the thyroid cartilage is cut in more places than one, and the different pieces are much separated from each other, it will be necessary to make use of one or two stitches, passed either through the integuments or through the cellular tissue contiguous to the cartilage, in order to maintain the divided portions in contact with one another.

The pharynx is very seldom wounded in the cases where the knife first enters the thyroid cartilage, but such a circumstance may happen, and an example of this occurrence is detailed by M. Fene in the eighty-third volume of the *Journal de Médecine*, &c. The patient, who was suffering under alienation of mind, pushed a knife through the thyroid cartilage, and, moving it about in all sorts of directions, made an irregularly round wound, about an inch in diameter, in this cartilage, and likewise another, nearly half an inch across, in the pharynx. All attempts to close the external opening by plasters and bandages were hurtful, and induced a great degree of dyspnœa. The food made its way into the larynx and was rejected by the wound till the 25th day, after which time the power of swallowing returned, and the cure was complete at the end of thirty-six days.

This case illustrates, in a striking manner, the strong natural tendency of wounds in the laryngeal cartilages to heal, and proves how little occasion we have to fear the formation of an aerial fistula when so extensive an injury of the thyroid cartilage, complicated with a large opening into the pharynx, can heal in five weeks almost without surgical interference.

When a wound is made in the space between the thyroid and cricoid cartilages, the lower part of the pharynx is more likely to be injured than when the knife first comes in contact with the thyroid cartilage. The consequences of such an injury will be a troublesome cough at every attempt to swallow, and the escape of the food through the external opening. These disagreeable and baneful effects must be prevented by the use of a tube passed into the œsophagus, after the same manner as when the incision has

been made in the crico-thyroid space. It is true that persons have been supported for many days by clysters of nutritious substances and the use of the warm bath; but, as a general rule, the injection of liquid nourishment by means of the œsophageal tube is preferable.

With respect to the use of sutures in wounds of this description the opinions of authors vary considerably. If the divided cartilages are completely separated by the knife, the gaping of the wound is so great that, in order to bring its edges into juxta-position and to ensure the mesial direction of the lower part of the air tube, one or two stitches will, I conceive, be advantageous; but if respiration be obstructed, or if the edges of the wound become emphysematous, the sutures must be instantly divided. A case illustrative of these observations will be found in Mr. Wood's paper, "On Wounds of the Throat;"¹ it is translated from Dr. Rust's monograph on this subject. A girl cut her throat, and the wound penetrated between the thyroid and cricoid cartilages and through the anterior wall of the pharynx. The severed windpipe was drawn considerably downwards, and was apparent only during coughing. The cut surfaces of the windpipe were united by a single loop, and those of the integuments by the interrupted suture. In a short time there was hemorrhage from the wound and threatening suffocative cough, whereupon the bandages and sutures were removed, and two blood-vessels tied, when the parts were adjusted as before. As every attempt to drink produced violent cough, she was nourished by clysters, and the thirst was appeased by warm baths. On the 9th day the sutures were removed, though for some time afterwards the food continued to come through the wound. Ultimately the patient completely recovered, with the exception of hoarseness.

Wounds of the trachea may include only a part of the circumference of this tube, they may totally divide it, and, in addition, they may be complicated with a wound, or with a complete division of the œsophagus. When the incision is not of sufficient extent to divide the whole circumference of the windpipe, the treatment is exceedingly simple; no sutures are necessary, and the simplest dressings need only be applied; but the forward position of the head must be carefully maintained till the wound has closed. If the division of the trachea be complete, it may be necessary to have recourse to sutures, but not in all cases; the effects of position should first be tried, and if the lower part of this tube has not retracted to a great extent, a sufficient approximation of the cut edges may be accomplished. But, in the majority of cases of complete division of the trachea, the lower end is very much drawn down by the action of the elastic membrane which forms so large a portion of the windpipe, and the forward inclination of the head is insufficient to bring the divided edges in contact. Then one or two points of suture through the cellular tissue surrounding the

¹ Lib. cit. p. 207.

windpipe, become indispensable. They are also generally called for in old persons, from the relaxed and wrinkled state of the skin, and its disposition to fold inwards when the head is much bent towards the chest. When the œsophagus is wounded, the elastic tube must be carefully introduced, and if its presence does not produce too much irritation, it should be suffered to continue there till the communication with the trachea has healed, and that the least possible inconvenience may accrue from its use, it should be passed by way of the nostril.

Wounds of the trachea require, perhaps, more constant and vigilant care on the part of the surgeon than those of any other division of the air tube. In the first place, great attention must be paid to the total suppression of hemorrhage previously to the closing of the wound, which must be kept open as long as any blood continues to flow; and if bleeding has already taken place into the trachea it may be necessary to enlarge the wound, and to place the patient in a situation favourable for the outward flowing of the blood. The next danger to be guarded against is the occurrence of emphysema, which can only arise from a too rigid union of the edges of the wound by sutures and adhesive plasters. Sutures, when used at all, should only include the cellular substance external to the trachea or the proper membrane of this tube, but the integuments should invariably be left free from stitches. Wounds of the skin, under these circumstances, never heal by the first intention, and therefore no object can be gained by the introduction of sutures through the skin. Their ill effects have been often seen, as, for example, in the case of the pastry-cook mentioned by Ambrose Paré; in whom, after a sword wound in the trachea, which had been accurately sewn up, emphysema took place to such an extent that in the face no appearance either of nose or of eyes could be perceived. Two cases have already been mentioned in which death took place from hemorrhage into the trachea, after wounds in that organ had been accurately united by sutures. The third cause for apprehension in these cases is, lest the granulations from the edges of the wound, or a chronic thickening of the mucous membrane, should so narrow the area of the windpipe as to cause a fatal obstruction to respiration. This effect must be chiefly combated by internal treatment and by the emission of blood; and the same remark holds good with regard to a fourth source of danger, viz. the propagation of inflammation along the mucous membrane of the trachea to the bronchi and their ramifications.

Hitherto I have spoken only of the local treatment of wounds of the trachea and larynx, but in no class of surgical cases is more attention required to their general management. The indications are few and simple, but important;—the preservation of the most perfect quietude, and the prevention or subduing of inflammatory action. The maintenance of perfect quiet, both as to the movements of the body and the emotions of the mind, where this is possible, is of the utmost importance to the well-doing of wounds of

so much consequence as those now under consideration. The unhappy state of mind of those who have attempted to commit suicide is very unfavourable to their recovery, but, unfortunately, little can be done for the relief of mental distress. To cheer the wounded spirit, to remove despondency by pointing out sources of consolation, and exciting hopes and anticipations for the future, and to induce repentance for the rash act already committed, are the *deciderata*, and the accomplishment of them must be left to judicious and well-timed efforts suited to the circumstances of individual cases.

The other indication is, to prevent or subdue inflammatory action in the mucous membrane of the air passages and lungs, which is the principal danger to be apprehended in wounds of the larynx and trachea, after the patient has escaped the immediate risks attendant on these accidents. Dr. Rust, in some important observations on cases of this kind, says, "I was never fortunate enough to save any men thus wounded, unless where the powers had been almost exhausted by the accidental or prescribed loss of blood. All injuries of this sort have proved fatal when immediate assistance was afforded, and usually the quicker as the loss of blood was smaller, and the patient's strength promised a longer duration of life."¹ To prevent the subsequent inflammation of the windpipe and lungs, he recommends large doses of calomel, mercurial frictions, cold lotions to the neck, active local as well as general bleeding, in a word, the reduction of life to the lowest pitch. These remarks are illustrated by the detail of three cases in which his principles were carried into action; two of the patients recovered after vitality had been almost extinguished, and the third died, in Dr. Rust's opinion, because the depletion was not sufficiently active. The views he unfolds are novel and bold, but I should hesitate considerably before adopting them in their fullest extent. To obviate the occurrence of inflammation, the patient must be kept in an apartment the temperature of which is never suffered to become cold, in a state of complete repose, and the diet should be the mildest and lightest possible; but before having recourse to the severe treatment advocated by Dr. Rust, we must wait till symptoms indicative of increased action in the membrane of the air tubes display themselves, and then adopt the most energetic antiphlogistic measures. No surgeon would hesitate to abstract blood locally and generally in this sort of consecutive inflammation of the windpipe or lungs, however much the patient had been reduced previously; but, as a general rule, anticipatory bleedings do not prevent inflammatory diseases, they most commonly destroy the vital power of the patient without checking the tendency to morbid excitement.

¹ *Medico-Chirurgical Transactions*, vol. xvii. p. 214.

CHAPTER XVI.

INJURIES OF THE LARYNX FROM DRINKING BOILING WATER
AND CONCENTRATED ACIDS, AND FROM THE INHALATION OF
FLAME.

Scalding of the glottis, in consequence of drinking boiling water from the spout of a tea-kettle, is an accident of not unfrequent occurrence: the sufferers are, in every instance, young children, who fall into this mistake from having been often allowed, by their unthinking parents, to help themselves from the kettle in a similar manner when the water has been cold. The occurrence of this accident and the severe effects which follow it were, I believe, first described by Dr. Marshall Hall,¹ but since the publication of his paper on the subject, numerous instances have been related in the medical journals, and the records of every hospital prove how frequently life has been sacrificed in this manner.

The prevailing symptoms are those indicative of an inflamed and obstructed condition of the glottis, together with difficult deglutition, pain at the precordia, and in many cases incessant vomiting. The following case (the second of Dr. Hall's) affords an abstract of the usual course of this affection:—

“John Langton, aged 2. In August, 1816, about 8 o'clock in the morning, and just after the water had boiled for breakfast, he attempted to drink through the kettle-spout. He cried out immediately. In about four hours he began to labour and rattle in breathing; the dyspnœa increased gradually; at length the face became livid and the feet cold, and he died from suffocation about seventeen hours after the accident. There was not much difficulty in swallowing, and there was no vomiting.”

In the following case there was frequent vomiting, as well as an obstructed state of the respiration.

CASE.

Eliz. Thomson, a healthy child, aged four years, swallowed some boiling coffee from the mouth of a kettle, about five o'clock in the evening of the 27th of March, 1837. Half an hour afterwards, when she was taken to the Birmingham General Hospital, the respiration was unaffected, but the voice was rather hoarse. On examining the mouth, the uvula was observed to be swollen, but the other parts were natural.

At six o'clock, the child was restless and cried frequently; the respiration was sonorous; the tongue and pharynx were swollen—the latter considerably—and covered with white flakes, probably the scaled epithelium. Ordered to take two grains of calomel

¹ Medico-Chirurgical Transactions, vol. xii. p. 1.

every two hours, and to have the outside of the neck blistered with acetum lyttæ.

At eight, the respiration was croupy; the child dozed at intervals, with great restlessness at other times. A tea-spoonful of syrup of poppies was ordered to be taken with each powder. About two o'clock in the morning she had become worse, and her breath was drawn with so much difficulty that the mother thought she was dying. Vomiting took place soon after, and the child was immediately relieved. She vomited several times during the night, and was very restless.

28th, nine o'clock A. M. Respiration raucous, sixty-six in a minute; pulse 160, small and irregular; lips bluish. Has taken sixteen grains of calomel. Mouth and nostrils inflamed. At noon the breathing was still sonorous, but did not betray any symptoms of being obstructed.

29th. The child slept much yesterday, and was restless at night. The respiration is now fifty-six, with a feeble croupy sound during the act of inspiration. She continues drowsy, has vomited repeatedly, and on the last occasion ejected a lumbricus. The speech is improved.

30th. The respiration is thirty-six and perfectly free. From this time the little patient gradually recovered, without any occurrence worthy of remark.

In a case related by Dr. Burgess,¹ the progress of the symptoms was exceedingly rapid. "Great swelling of the parts immediately ensued, which not only prevented deglutition, but impeded respiration very considerably. In about two hours after the accident I saw her (a girl, aged 3 years). On looking into the mouth, it appeared as if a large piece of raw flesh had been forced into the fauces and had filled up the passage. Respiration was performed with great difficulty, and was momentarily becoming very laborious; in fact, the child soon appeared to be dying." Tracheotomy was had recourse to immediately, with speedy relief to the respiration, but swallowing could not be accomplished; nor was it till the eighth day that Dr. Burgess was able to introduce an elastic tube into the stomach by way of the nostril. The patient was supported in the mean time by nutritious enemata. By the tenth day she could breathe through the natural passages. "On the twelfth day she could swallow fluids, and at the end of three weeks the deglutition of solids could be performed, the wound was healed, and natural respiration completely restored."

The general course of the symptoms produced by the attempt at swallowing boiling water is, in the first instance, inflammation, swelling and rapid vesication of the tongue, palate and pharynx, which cause deglutition to be exceedingly painful or quite impracticable. After the lapse of one or two hours signs of the existence

¹ Dublin Hospital Reports, vol. iii. p. 380.

of an obstruction to respiration commence; this may be occasioned partly by the swelling of the fauces, but more particularly by inflammation about the orifice of the larynx, and the consequent infiltration of the sub-mucous cellular structure. In a short time afterwards the breathing becomes hurried and sonorous; the inspirations are especially difficult, and attended by a stridulous noise like that which is heard in idiopathic croup. If this state is not speedily relieved the pulse becomes weak and intermitting, the face livid, the extremities cold, and death takes place either in a paroxysm of suffocation, or from the supervention of coma in consequence of the obstructed respiration.

In many of the cases, frequent attacks of vomiting have come on in the course of a few hours after the accident, and they have been supposed to have arisen from the swallowing of some of the scalding water; but, in all probability, the vomiting is more the effect of sympathy than of the hot water having found its way into the stomach, for the immediate effect of the water upon the pharynx is such a spasmodic action of its muscles as causes its instant rejection by the mouth; there is, therefore, great reason to believe that the boiling water never penetrates farther down the alimentary canal than the pharynx, and that it never reaches any other part of the larynx than the posterior surface of this organ and the epiglottis. Moreover, it may be remarked, with reference to this point, that inflammation of the stomach is not mentioned in any of the cases of this accident, amongst the appearances found on a post mortem examination of the bodies; and vomiting is a very frequent attendant in cases of idiopathic croup.

The cadaveric appearances in those who have died from the effects of this accident are, unfortunately, recorded only in a small number of instances. They are redness and tumefaction of the fauces and pharynx, an œdematous state of the epiglottis and upper margins of the larynx, and, where life has been prolonged for some time, a swollen and greatly injected condition of the mucous membrane of the trachea and bronchial tubes. Sometimes a deposition of lymph takes place on the inflamed lining membrane of the trachea.¹ In one instance, "the œsophagus, to within a short distance of the cardiac orifice of the stomach, presented the usual appearances of a scald, and the cuticle was easily peeled off from parts of the tongue and upper part of the œsophagus."²

The symptoms and the pathological changes that occur in these cases resemble accurately those of acute laryngitis from any other cause; and unquestionably the effect of the boiling water upon the parts with which it comes in contact is to excite inflammatory action, and to produce tumefaction of the mucous membrane, and serous infiltration into the sub-mucous cellular tissue. Those

¹ Mr. Gillman, *Medico-Chirurgical Transactions*, vol. xii. p. 9; Porter, second edition, p. 183.

² Gillman, *loc. cit.*

organs within the cavity of the mouth which are possessed of an epidermis undergo speedy vesication. The difference between the effects of this accident and idiopathic laryngitis is to be found in the extreme rapidity of the symptoms in the former affection, and in the simultaneous existence of great tumefaction of the tongue and fauces, which increase the natural difficulties of the case by creating a powerful impediment to the performance of deglutition, and sometimes also to that of respiration.

Considering the result of this accident to be the production of acute inflammation in the upper part of the larynx, the treatment must be vigorously antiphlogistic. Leeches should be immediately applied to the neck in the vicinity of the larynx, and a large blister should be raised upon the upper part of the chest by means of the acetum lyttæ, if the symptoms are very urgent, or in the ordinary method when the circumstances of the case will permit the delay. To these external measures must be joined the exhibition of such medicines, as will act promptly in subduing the inflammatory action, and of this class of remedies calomel holds the first rank. The utility of calomel in cases of this description was first pointed out by Dr. Wallace, of Dublin,¹ and the success with which its administration has been attended, both in his own practice and in that of others, seems fully to justify the encomiums of its recommender. In illustration of his manner of giving this medicine, and of the benefit to be derived from its use, Dr. Wallace gives the details of two cases, in which it was successfully employed. In the first instance, a boy, aged three years, had drunk boiling water from the spout of a tea-kettle, and was not seen by Dr. Wallace till eleven hours after. Together with intense dyspnœa, there were symptoms of collapse, such as weak pulse, cold extremities, and restlessness. Six leeches were applied over the larynx, a large blister to the upper part of the chest, and three grains of calomel were administered every hour. In the course of a few hours the bowels were copiously moved two or three times, and the difficulty of breathing rapidly diminished. On the third day the child was convalescent. The details of the second case are of a similar nature, except that leeches and tartar emetic were tried for the first twenty-four hours, and as no relief had been obtained by their use, mercury was had recourse to, in doses of two grains of calomel every hour. Twelve hours afterwards the child's state was greatly improved, and on the third day there was no longer any difficulty of breathing. From this period the child got rapidly well, and exhibited no particular symptoms.

With great fairness, Dr. Wallace presents us immediately afterwards with a case in which the mercurial treatment, though commenced soon after the accident, completely failed in arresting the symptoms, and in which tracheotomy, performed about twelve hours from the occurrence of the accident, was attended by speedy relief and ultimate recovery.

¹ *Lancet*, for 1833-4, p. 657.

Other cases, illustrative of the beneficial effects of the calomel treatment, may be found in various numbers of *the Lancet*.¹ The dose of this medicine, and the frequency with which it should be given, must be regulated in some measure by the age of the patient and the urgency of the symptoms. As long as the respiration is croupal and very rapid, two or three grains of calomel must be given every hour; when the frequency and the labour of breathing diminish, the intervals between the doses may be lengthened to two, three, or four hours, but the administration of the remedy should never be entirely suspended till the patient is convalescent, or till salivation is established.

Although the mercurial treatment in this species of injury of the larynx appears to have been generally very efficacious, there are some circumstances which may render its adoption impossible, or which demand a previous recurrence to other measures for ensuring the safety of the patient from immediate death by suffocation; I refer to the operation of tracheotomy.

The administration of calomel may be rendered impracticable by the existence of such a degree of swelling of the fauces and pharynx as will put a stop, for a time, to the function of deglutition. Dr. Burgess's first case, which has before been referred to, affords an illustration of this point; the tumefaction of the parts at the back of the mouth was so great that it was impossible even to pass a tube into the œsophagus, either by way of the mouth or of the nostrils. In this and in similar cases, therefore it is necessary to pursue some other plan of treatment.

The imminence of suffocation from the effects of the scalding water upon the fauces or larynx may be so great that the operation of tracheotomy is imperatively and immediately called for to save the life of the patient. But in such cases it is generally expedient to have recourse to the mercurial treatment after the operation; and the creating an artificial passage for the air is to be considered chiefly as a means of gaining time for the operation of proper remedial agents, and not as of itself a curative measure.

Tracheotomy has been performed many times in cases of scalded glottis, and with variable success. Dr. Burgess performed the operation, in one instance, two hours after the occurrence of the accident, and the patient completely recovered. "The usual treatment for inflammation was pursued" after the operation.² Dr. Wallace practised it successfully twelve hours after the accident; the child had previously taken eighteen grains of calomel, and this medicine was continued, in smaller doses, for four days afterwards, indeed, till all obstruction to respiration by the natural passages was removed.³ Dr. Smyth performed tracheotomy with success

¹ See *Lancet* of the 19th of March and the 16th of April, 1836, and of the 11th of February, 1837.

² *Dublin Hospital Reports*, vol. iii. (Case I.)

³ *Lancet*, loc. cit.

twenty-four hours after the accident; in this case also the calomel treatment had been commenced several hours before the operation was undertaken, and was continued afterwards till salivation occurred.¹ Mr. Adams performed the operation successfully nine hours after the accident; bronchitis ensued in the course of a few hours, but the patient recovered by the 14th day. No record is made of the treatment pursued after the operation.²

Tracheotomy was performed by Dr. Burgess, in a second case, eight hours after the occurrence of the accident; the child appeared lifeless at the time it was done, but afterwards revived and died in about twelve hours, in consequence of the neglect of the attendants to keep the wound in the trachea free.³ In Dr. Marshall Hall's fourth case, the operation was performed twelve hours after the accident, and the little patient died thirty-four hours afterwards, "apparently from the exhausting influence of the original disease."⁴ In two cases related by Dr. Wallace, in a clinical lecture on this subject, the operation was performed without averting the fatal consequences of this accident.⁵ In the first case it was done thirteen hours after the infliction of the injury; the child died in twenty-one hours afterwards, and on examining the body the bronchial tubes and the lungs were found extensively inflamed. In the second instance the operation was performed fourteen hours after the accident, and the patient died, about twenty-four hours afterwards, with symptoms of difficult respiration and general convulsions. After death the trachea was found to be inflamed and full of reddish mucus, there were marks of recent pneumonia, and the vessels of the brain and of its coverings were gorged with blood. In none of these four cases does there appear to have been any active treatment pursued after the performance of tracheotomy.

The unsuccessful result of the four last cases should not weaken our confidence in tracheotomy, as one important relief in the affection we are now considering: it should, however, caution us from trusting too implicitly to the agency of the operation alone, which, there is every reason to believe, will not cure the laryngitis that has given rise to the urgent symptoms of obstructed respiration, though it will render the breathing for a time free, prevent suffocation, and afford us the opportunity for using those remedies which are necessary for subduing the inflammatory action. The post mortem examination of the bodies in the two last cases, showed clearly that death was caused by the extension of the inflammation along the trachea to the bronchial tubes and the lungs; a wound in the trachea would rather expedite than check this propagation of the morbid action; for some degree of inflammation almost invariably

¹ Lancet for April 9th, 1836.

² Porter's Pathology of the Larynx, &c. second edition, p. 187.

³ Dublin Hospital Reports, loc. cit.

⁴ Medico-Chirurgical Transactions, vol. xii. p. 5.

⁵ Lancet for March 19th, 1836.

follows the operation when performed under any circumstances. From these considerations, therefore, we must conclude that antiphlogistic treatment, and especially the use of calomel, is as necessary after the performance of tracheotomy as it is before, and that this operation only relieves the labour of breathing and averts impending suffocation. These conclusions are fully borne out by the result of three at least of the successful cases, in which either "the usual treatment for inflammation was pursued," or the administration of calomel, which had previously been commenced, was continued after the operation, till the symptoms of impeded respiration by the natural passages disappeared, or till the mouth was affected.

With respect to the time at which tracheotomy should be proposed; whilst we have such weighty evidence in favour of the success of the mercurial treatment, we are certainly not justified in having recourse to the operation in the first instance, without giving a trial to this medicine, assisted, as it may be, by the application of leeches and blisters. If the symptoms, however, do not yield to the medical treatment, or if the patient, when first seen, appears to be in immediate danger of suffocation, tracheotomy should be promptly performed. Blueness of the lips and nails, the occurrence of accesses of suffocation, and the presence of signs indicating the approach of coma, should, perhaps more than any thing else, determine us immediately to have recourse to the operation. The existence of a complete impediment to deglutition would also render necessary the speedy performance of tracheotomy.

Injury of the larynx from drinking concentrated acids.—This is a case of very infrequent occurrence, and it is a singular fact that the larynx suffers injury from the swallowing of any of the strong acids only when they are taken accidentally, in mistake for some other liquid. A person bent on suicide will swallow these corrosive acids well and without complaining of pain. Mr. Porter says, "I have known a young girl, after taking sulphuric acid, sit quietly and drink tea with some females, who were afterwards suspected of poisoning her, although the dose had been so powerful that she died in a few hours; and I am aware of a man who took a second glass of the same acid, because he thought the first was not sufficiently quick in despatching him.¹ In these cases the larynx is never injured; the epiglottis, during the act of swallowing, completely covers the upper surface of the glottis, and the corrosive acid passes down the œsophagus to the stomach without impairing, in any way, the organisation of the larynx. But if the acid is taken accidentally, immediately that it reaches the gullet the mistake is discovered, violent actions of the muscles of the pharynx is excited, and the corrosive liquid is rejected through the mouth and nostrils.

¹ Pathology of the Larynx, &c. 2d ed. p. 177.

In the former class of cases, the effects of the acid, as long as life continues, and after death also, are to be found on the mucous membrane of the mouth, pharynx, œsophagus and stomach, all of which organs become corroded and violently inflamed.¹ In the latter class of cases the parts that chiefly suffer are the mouth, pharynx, epiglottis, and sometimes the lips of the glottis. The lining membrane of the mouth is more or less disorganised, generally hardened, whitish or yellowish with sulphuric acid, yellowish with nitric acid. The mucous membrane, in some instances, has been found stripped from the muscular coat of the mouth and pharynx.² In a case of the swallowing of sulphuric acid, alluded to by Mr. Porter,³ in which death supervened in a few hours, besides a black and charred state of the root of the tongue and the back of the pharynx, the superior portion of the larynx was inflamed and slightly œdematous.

When the larynx is injured by the attempt to swallow the strong acids, or by their forcible administration to children with an intention of committing murder, the usual signs of laryngitis will present themselves, complicated with great difficulty in the act of deglutition; and death may occur from the laryngeal mischief without the acid having ever reached the stomach, or even the œsophagus.

The treatment of such cases, as far as the larynx is concerned, should be directed towards the subduing of inflammatory action, and the removal of obstruction to the passage of the air. Leeches and blisters externally, and calomel internally, would constitute the basis of the medical treatment, and the operation of tracheotomy might very probably be rendered necessary by the existence of such a degree of impediment to respiration as threatened speedy suffocation. The prognosis in these cases will, however, be always unfavourable, on account of the great mischief that must necessarily be occasioned by the pharynx and fauces from the contact of the corrosive acid.

Injury of the larynx from the inhalation of flame?—I propose the heading of this section with considerable hesitation, because I have been unable to find any mention of the inhalation of flame as a cause of injury to the larynx, either in works upon the subject of burns or of diseases of the larynx. I shall confine myself, therefore, to the recording of one or two observations of an inflamed state of the larynx and trachea, which seemed to have had its source in the breathing of flame, or at least of intensely heated air. It is right to state that the morbid appearances discovered in these cases after death were by no means anticipated, and that the symptoms during life were those of severe bronchitis, without any of that peculiar dyspnœa that results from an obstructed condition of the laryngeal aperture.

¹ Christison, On Poisons, p. 128.

² Christison, loc. cit.

³ Pathology of the Larynx, p. 181.

Matilda Smith, aged eighteen, was burnt in a dreadful manner over the whole body, but especially on the face and neck. All her clothes were burnt, and she was enveloped in flame for some minutes. She was brought to the Birmingham Hospital immediately, and died on the fourth day with symptoms of bronchitis. The larynx was examined, and the following appearances presented themselves:—There was scarcely any tumefaction of the parts. The epiglottis, the cavity of the larynx, and the upper part of the trachea, were invested with a thin uniform coating of lymph, not organised, and only very slightly adherent to the mucous membrane. Its thickness was greatest at the epiglottis, and progressively diminished downwards. The membrane beneath was intensely red or deep purple, but was not much altered in consistence. The mucous membrane of the trachea and larger bronchial tubes was highly vascular.

For this case I am indebted to Mr. Bowman, house-pupil at the Hospital: a short time afterwards the same gentleman sent me a larynx, for examination, which had been taken from the body of a girl seventeen years old. She was brought to the hospital very much burnt about the body and neck, and died with symptoms of acute bronchitis on the fifth day from the receipt of the injury.

The mucous membrane of the edges of the epiglottis, the internal surface of the larynx, and the upper part of the trachea, were of a cherry-red colour, extremely vascular, pulpy, and rather thickened. The thyro-arytænoid ligaments and muscles were exposed, in consequence of the destruction of the mucous membrane in these situations; the membrane investing the internal surface of the arytaenoid cartilages was excessively red, and had a granular appearance, as if it had been deprived of its epithelium by the action of fire; the internal angles of both arytaenoid cartilages were exposed and sloughy. The area of the larynx generally, and of the rima, was not diminished to such a degree as would occasion any obstruction to the passage of the air. There was a thick mucous secretion over the whole lining membrane of the larynx and trachea.

Soon after the occurrence of this last case I had the opportunity of examining the larynx and trachea of two children, who were lying dead at the same time in one of the public institutions of this town. Both of them had died within twenty-four hours after the receipt of severe burns from their clothes catching fire. One of them, a boy about four years old, was much burnt about the face, neck, and chest; the inner surface of the lips was also injured by the flame. The whole lining membrane of the larynx and trachea, and particularly the posterior part of the latter, were intensely red and very much injected; there was no thickening or pulpiness about the membrane. The trachea was filled with thick mucus. The pharynx was also of a vivid red, the colour terminating abruptly at the commencement of the œsophagus.

The other child, a girl about twelve years of age, was burnt on the chest, body, and thighs, but not on the neck or face. The

larynx and trachea were congested, but not inflamed; the colour of these parts was of a dull violet tinge, which was owing to the repleted condition of the venous system of the sub-mucous tissue. The vessels of the surface of the membrane were not injected, the membrane itself was of a healthy consistence, and there was no mucus in the larynx or trachea.

The subjects of the three first observations were all very much burnt about the face and neck, and it is, therefore, certain that they must have inhaled air at a very high temperature, if not actual flame; they appeared to be suffering before death from acute bronchitis. On a post-mortem examination the superior parts of the air passages presented marks of acute inflammation, but of different characters. In the instance of Matilda Smith the mucous membrane of the larynx and trachea was of a deep purple colour, and covered with a layer of coagulable lymph. In the subject of the second observation the same membrane was highly inflamed, with loss of substance over the internal angles of the arytaenoid cartilages and the thyro-arytaenoid ligaments and muscles; the parts, be it observed, with which the heated air would come into closest contact, on account of the narrowness of the larynx at these points. Whether the loss of substance was produced by ulceration or by the previous detachment of sloughs in these situations, it was impossible to determine. The larynx of the little boy exhibited the appearances of incipient acute inflammation, but the time that elapsed between the occurrence of the accident and his death had been so short, that, besides extreme injection of the vessels of the mucous membrane, no other result of inflammatory action was observable. In the last example there was congestion, but no inflammation; and the absence of inflammation must be considered in reference to the situation of the burns being upon the body and thighs only, and not upon the face or neck.

The discovery of three instances of inflamed larynx at one institution and within a comparatively short time, the subjects of such disease having been, in each case, severely burnt about the neck and face, and from the nature of the accident—the burning of their clothes—probably enveloped in flame for a minute or two at least, would appear to depend on something more than simple coincidence. Nor should I hesitate in the least about assigning the laryngitis to the inhalation of heated air as a cause, were it not for the silence of all writers upon the subject of burns as to such an occurrence.

Mr. Samuel Cooper remarks, that “it has been observed that persons who die of severe burns seem to experience a remarkable difficulty of breathing and oppression of the lungs.”—“The asthmatic symptoms frequently noticed in cases of burns are probably owing to a sympathy between the lungs and skin, or else to causes not at present understood.”¹ *The causes not understood* are, I apprehend, congestion and inflammation of the mucous membranes

¹ Dictionary of Practical Surgery, art. Burns.

of the air passages. M. Majolin observes, that "there are frequently found manifest traces of inflammation in the mucous membranes of the lungs and intestinal canal of those who have died of burns."¹ The cause of the bronchial inflammation may be, in many cases, the increase of labour thrown upon the lungs by extensive injury of the skin, and consequent suspension of its functions; and yet there may be many other cases in which the same effect is attributable to the direct application of highly heated air to the membrane of the air-tubes, and in which cases it is to be expected that the effects would be most severe upon the upper portions of these tubes, the larynx and trachea.

Considering the occasional existence of laryngitis in burns apart from the question of its origin, is the knowledge of such a complication of any practical value? I think it is; for in the first case recorded in this section there can be no hesitation in affirming that death would have resulted from the croupal disease in the course of a few hours if the patient had not died of the burn; and in the second case the laryngeal mischief was so extensive that, if the burn had not caused death, the exposure and the incipient sloughing of the arytaenoid cartilages would probably have ended in their complete destruction, and the patient would have either fallen a victim to the consecutive form of œdema of the glottis, to laryngeal phthisis, or would have recovered with a very impaired condition of the voice.

The detection of laryngeal disease under these circumstances would be difficult, on account of the general acceleration of the circulation and respiration that always attends extensive burns. Its treatment would be antiphlogistic, and the occurrence of croupal breathing would call for a free administration of calomel.

CHAPTER XVII.

FOREIGN BODIES IN THE AIR PASSAGES.

The entrance of a foreign body into the larynx or trachea is not an accident of very rare occurrence, especially to children, who, from their natural carelessness and want of consideration, are far more liable to it than those of maturer years. It may happen in various ways, but perhaps it has most frequently originated from an indulgence in talking or laughing whilst the mouth has been full of food, or has contained any substance capable of slipping easily through the rima glottidis. The manner of its occurrence under these circumstances is this:—Preparatory to speaking or laughing, a full, deep inspiration is necessary, and the air is very commonly drawn through the mouth; the edges of the glottis are, at this

¹ Dictionnaire de Médecine, art. Brûlure.

moment, widely separated from each other; the mind, interested in the subject of conversation, is off its guard; and, therefore, a particle of food, a plum-stone, or whatever the mouth contains, is easily taken with the current of air into the larynx or trachea. If the intruding body be of small size and light, a severe fit of coughing will, in all probability, soon drive it back again through the rima with considerable force; but if it is heavy, broad, oblong, or of an irregular figure, it may become permanently fixed in the aperture or the ventricles of the larynx, it may remain in the trachea, or it may fall into one of the bronchi.

The external qualities of the extraneous body will, therefore, regulate, in a considerable degree, the situation that it will assume and maintain in the air passages, and its situation will, in like manner, influence the nature of the symptoms that will result from its presence. The consequences of this accident may be, 1st, Instant death, if the foreign body become impacted within the rima glottidis, or in the larynx immediately below this point; 2d. Pain somewhere in the course of the trachea, severe dyspnœa, and frequent convulsive cough, followed by death generally in three or four days after the accident, if the foreign body be small and light, and move with the air in respiration backwards and forwards along the trachea; and 3d. Symptoms resembling those of asthma and suffocative catarrh, which may terminate eventually in death or in the expulsion of the irritating substance during a fit of coughing; in such cases the body is commonly heavy, and has fixed itself in one of the bronchi, or at the entrance of some of their ramifications. This general statement comprehends the most important of the results of this accident; for the detail of other effects we must have recourse to the description of particular instances, and for these I must be indebted entirely to others, never having myself met with an example of this untoward accident.

Foreign bodies in the larynx.—With regard to those cases in which death takes place immediately from the impaction of any foreign substance in the rima glottidis or in the cavity of the larynx, very little need be said; in fact, the only symptom is instant suffocation, and surgical assistance is quite unavailing when no interval exists between the state of perfect health and dissolution. An instance of this kind is given in Haller's works. He opened the body of a child who had been suddenly suffocated by a filbert, and it was found below the glottis, at the base of the thyroid cartilage, just over the entrance into the trachea. Nothing is said about the manner in which the nut got into the larynx, but, considering the pointed form of one of its extremities, it is probable this end first passed through the rima, and its size would be sufficient to account for the suffocation that ensued. The facility with which a foreign body enters the larynx, compared with the impossibility of its being again expelled through the same aperture, though the muscles that produce expiration are so much more powerful than those that cause inspiration, is accounted for by the fact that the rima glottidis

becomes dilated during a full inspiration, that it is smaller during expiration, and that when coughing takes place it becomes greatly contracted.¹

Mr. Porter was called upon to examine the body of a child who had died of suffocation after thirty-eight hours of suffering from dyspnœa and convulsive cough, the cause of which could not be divined: part of an almond shell was found entangled in the rima glottidis, effectually closing the aperture for the admission of air. In this case the extraneous substance had unquestionably been lodged in the trachea till a paroxysm of cough had thrown it into the rima, which it had choked up, and the child died from direct suffocation.²

In the following example instant death took place from a quantity of food getting into the air passages:—

A stout, hearty labourer died suddenly whilst eating his Sunday's dinner of boiled beef and cabbage. I was present at the examination of the body, which was made on the following day. The stomach was enormously distended with the above mentioned aliments; the œsophagus and pharynx were equally full; a piece of meat occupied the rima glottidis, and a quantity of masticated beef and cabbage was found in the trachea, the bronchi, and even in the most minute ramifications of the bronchial tubes as far as they could be traced. It seems probable that this unfortunate man had filled his stomach so much as to produce vomiting, and that he had endeavoured to perform the act of inspiration at the time that the superabundant food was being rejected; under these circumstances, of course, no assistance could be expected from the epiglottis, for, its action being chiefly mechanical, it would be pushed as far as possible from the entrance to the larynx whilst vomiting was going on.

In a case of this description surgical assistance, however prompt, could not have been of the slightest avail; but in the instance mentioned by Haller, where the filbert was situated above the trachea, tracheotomy, performed at the moment, would have saved the child from immediate death, and might very possibly have led to the extraction of the foreign body.

Foreign bodies occasionally fall into one of the ventricles of the larynx, and are thus prevented from getting into the rima; the effects they produce when thus situated are not generally so severe as when they are in the direct course of the respiration. Thus, Pelletan speaks of a man who desired his assistance on account of a severe cough and an occasional sense of suffocation, under which he had laboured for six weeks. Upon inquiry, these symptoms were found to have arisen from a button-mould having got into the larynx. The trachea was opened, but though the button was felt, it could not be extracted; the cricoid cartilage was then divided,

¹ Porter, Pathology of the Larynx, note, p. 204.

² Pathology of the Larynx, &c. p. 181.

and the foreign body was taken out of the left ventricle of the larynx.¹

In the following instance death was caused by a leech getting into one of the ventricles of the larynx:—A soldier, after a march, during which he had repeatedly drunk water from the pools by the road-side, was suddenly seized with symptoms of suffocation, and died whilst preparations were being made for performing the operation of tracheotomy. An examination of the body showed that there was a leech in the right ventricle of the larynx; its body greatly obstructed the glottis, and rendered the entrance of air by this opening almost impossible.²

It is not very easy to ascertain the exact position of any extraneous substance that may have found its way into the air passages, but as a practical question this is not of much importance; for if any person were suffering from the effects of an accident of this kind, it would unquestionably be the duty of the surgeon to open the trachea, and if the foreign body were not rejected, and if, at the same time, the symptoms continued, the wound should be extended into the larynx, unless there were indications of the body having fallen into the bronchi.

Foreign bodies in the trachea.—The second class of cases includes those in which a small light body, such as a bean or a cherry-stone, falls or is drawn into the trachea: it is by far the most numerous class, and happily the means of affording relief, when used in time, are tolerably certain of success.

M. Louis, in his excellent memoir on this subject, contained in the fourth volume of the *Memoires de l'Académie de Chirurgie*, narrates a case which occurred under his own observation, and which exhibits, in a striking manner, most of the usual effects of this accident. I shall, therefore, take the liberty of presenting it in an abridged form:—

At five o'clock in the evening of Monday, March 19th, 1759, a girl, aged seven years, whilst playing with some dried beans, threw one of them into her mouth, and thought she had swallowed it. She was immediately attacked with difficulty of breathing and a convulsive cough, which was productive of great fatigue. A probang was passed down the œsophagus, and various remedies administered, without effecting any change for the better. She had frequent attacks of most distressing cough, which excited violent convulsions in all her limbs, and many times she lay in the arms of her parents, ready to expire from suffocation; at the same time she could swallow any thing that was given to her without difficulty. The little patient continued in this condition for two days, when M. Louis was asked to visit her. "I found her," says the author, "sitting up in bed, resting on her hands, and having as the only symptom a most laborious respiration." She pointed with her finger

¹ Clinique Chirurg., tome i. p. 8.

² Gazette de Santé, Février 25, 1828.

to the trachea, midway between the larynx and sternum, as the place where she felt pain: breathing was accomplished with difficulty, and attended by a rattle and the occasional expectoration of a frothy matter. M. Louis, having no doubt that the bean was in the trachea, instantly proposed tracheotomy as a certain means of relieving the child, but his opinion was over-ruled. Two hours afterwards there was found a well characterised emphysema on both sides of the neck, just above each clavicle. Two grains of tartar emetic were exhibited without any good effect. On Thursday the respiration became more laborious, the child was nearly suffocated many times during the day, and she died in the evening, exactly three days after the accident. On an examination of the body, the bean was found loose in the trachea.

The chief symptoms that this case brings into view, as indicative of a foreign body having found its way into the trachea, are extreme difficulty of breathing immediately after the accident, frequent attacks of convulsive cough, with intervals of comparative ease; a sensation of pain somewhere in the course of the trachea, expectoration of a frothy, pituitous nature, perfect facility of deglutition, and, after the lapse of two days, emphysema of the lower part of the neck, and frequent approaches to suffocation. In the details of cases by other authors we find that mention is made of additional symptoms that may increase the facility of diagnosis, a subject of great importance where life is in such imminent danger from the slightest delay.

Mr. M'Namara narrates the case of a boy who had accidentally got a plum-stone into the trachea;¹ "he was instantly seized with a fit of suffocation, attended by violent coughing and expectoration of red, frothy blood." These ceased after a little time, when the boy played about as usual and seemed perfectly well, with the exception of being attacked every hour, or hour and a half, with fits of coughing and hoarseness. "These fits of suffocative cough were so peculiar that they could not be mistaken; during a paroxysm his countenance became purple, his cheeks were forced out, his chest was raised, and his neck swollen, in consequence of his efforts at expiration; in short, he was in the condition of a person who could fill the lungs with air without having the power of expelling it."—"Nor was this difficulty of expiration the result of the contraction of the muscles of the larynx; for whenever a paroxysm was severe, I could distinctly perceive that there was a mechanical obstruction to the exit of the air produced by the ascent of the foreign body to the larynx, causing a perfectly audible sound, which resembled more that produced by striking the tongue forcibly against the anterior part of the hard palate when the mouth is closed." Tracheotomy was performed on the day after the accident, and the plum-stone was expelled through the wound to the height of two or three feet.

Some inflammatory symptoms came on, but they were reduced by

¹ Dublin Hospital Reports, vol. v. p. 583.

the usual methods, and the little patient was discharged perfectly cured in ten days after his admission.

Remarks.—The details of this case add considerably to our means of diagnosis with respect to the occurrence of this accident, by pointing out that the suffocative paroxysm is caused by an inability to expel from the chest the air it contains, and must, therefore, be dependent upon the mobility of the foreign body in the trachea, and upon its being forced into contact with the under surface of the vocal cords at every attempt at expiration. The sound elicited by the plum-stone striking the larynx is another circumstance well worth keeping in mind, as, from the nature of the effects, it could not easily have been produced by any other cause. M. Dupuytren takes notice of the same effect in the case of a boy who had got a bean into his trachea; a shock was heard like that of a valve which strikes the edges of the opening it is destined to close.¹

M. Lescure gives some particulars of a case that came under his observation, in which a piece of the kernel of an apricot had fallen into the trachea.² The patient, a child, was immediately seized with difficulty of breathing and most violent cough, which latter symptom, however, soon ceased, and never again returned. The narrator of the case remarked that there was always a hissing noise during the process of respiration, and that the trachea, just below the larynx, swelled out in a manner that was sensible both to sight and touch at every movement of expiration. An emetic was the only remedial measure adopted, and the child died on the third day (sixty hours after the accident) from constantly increasing dyspnœa, without any change in the voice or the least return of the cough.

The examination of the body showed that nearly half an apricot kernel was lodged in the trachea, just below the cricoid cartilage; it appeared small enough to have moved freely in the trachea. The lungs were gorged with blood in several places and emphysematous throughout their whole substance, though the emphysema had not manifested itself externally.

Notwithstanding the remark of M. Lescure, that the foreign body seemed sufficiently small to have moved freely in the trachea, the enlargement of this tube during expiration, the constant whistling sound, and the absence of cough after the first few minutes, afford strong presumptive evidence that the body did not stir from the situation in which it was found after death. Moreover, there are cases on record where, from circumstances, it was impossible that the irritating body could have moved into the larynx, and where, nevertheless, the most dreadful dyspnœa was occasioned. In the same volume that contains the case last cited we find an instance of this:—M. de la Martiniere was called to a boy, aged nine, who, whilst amusing himself with smacking a whip, was suddenly attacked by an extreme difficulty of breathing, and in a few minutes

¹ *Leçons Orales*, tome iii. p. 595.

² *Mem. de l'Académie de Chirurg.* tome v. p. 349.

was almost suffocated; he complained by gestures of pain in the situation of the trachea. In the course of an hour he had convulsions and breathed most laboriously; his face was tumid and violet, his eyes prominent, and his extremities cold; he was senseless, and apparently moribund. M. de la Martiniere, in examining the neck externally, perceived a small wound no bigger than a flea-bite, together with a slight prominence just below the cricoid cartilage. He immediately cut down upon it and extracted a copper pin, nearly an inch and a half long, which traversed the trachea in a horizontal direction. The relief was immediate and permanent, and the boy was well in a few days.

At the same time that we remark the dreadful dyspnœa and the symptoms of approaching suffocation, that were produced by a foreign body that neither by its bulk could have obstructed the air passages, nor, on account of its fixed position, could have affected the larynx by actual contact, we must particularly notice that no mention is made of cough in this case; and in the preceding case the cough ceased in a few minutes after the kernel had passed the glottis, which in its transit it would undoubtedly have irritated. From these and other instances which might be cited, it is a reasonable conclusion that the cough is generally caused by the foreign substance coming into contact with the larynx, and therefore that when there is no cough the intruding body has taken up a fixed position.

The ways in which a foreign body may get into the trachea are various, and deserve some mention on account of the assistance given to our powers of diagnosis by a knowledge of the manner in which the accident has happened occasionally, and in which, therefore, it may again be brought about. The most common manner of its occurrence is where a person interested in a subject attempts to talk vehemently whilst engaged, at the same time, in eating; a strong inspiration is made by way of the mouth at the time that this cavity is full of food and the mind engaged, in the subject of discourse, and some portion of the contents of the mouth is drawn by the current of air into the trachea. Mr. M'Namara's case, cited above, originated under circumstances of this description. The subject of M. Lescure's case (mentioned above), whilst eating apricot kernels, fell down with half one in his mouth at the time, and it found its way, during the child's hurry, into the trachea. Another person, whose case is also detailed by M. Lescure,¹ was pretending, in sport, to throw a louis d'or into his mouth, when he unfortunately loosed it, and the coin went straightway into the air passages. The subject of M. Louis's case met with the accident, which ultimately proved fatal, after a similar manner. A fit of laughing when the mouth contained a filbert, a blow upon the back of a child who was eating chesnuts, the slipping of a ladder from under the feet of a

¹ Mem de l'Académie de Chirurg. loc cit.

man who was eating cherries at the time,¹ these are some of the ways in which foreign bodies have been introduced into the larynx or trachea; and, of course, when it is suspected that this accident has happened, the most minute inquiries should be made as to the actions of the patient at the moment that the symptoms first showed themselves, and especially as to whether the mouth contained any thing that could have found its way into the trachea.

Diagnosis.—The diagnosis of this accident claims the most minute attention, and we must avail ourselves of every circumstance at all calculated to throw light upon the subject. And, first, the previous history of the patient should be sedulously inquired into, as to whether he was subject to any pectoral affection, whether he had any cough or asthmatic tendency; next as to the nature of the extraneous substance suspected to have got into the trachea, its size and shape; the symptoms should be minutely examined with reference to making a distinction between this affection and acute laryngitis, croup, or a foreign body of large size in the œsophagus. From the two first it may be distinguished by the absence of fever at first, by the very sudden manner in which the symptoms come on, by the intermissions in the difficulty of breathing, which sometimes continue for an hour or two, by the noise occasionally heard when the foreign body is impelled against the vocal cords, by the excessive violence of the cough after this occurrence, and most particularly by the chief difficulty of breathing being during the time that the expiratory process is going on, whilst in laryngitis the difficulty is in the act of inspiration. From a portion of food or other substance of large size lodging in the pharynx or œsophagus, as in Habicot's case, mentioned by Louis, where suffocation was only prevented by tracheotomy,² this affection may be known by the facility with which deglutition is accomplished: nevertheless, it may be well, when there is any doubt on the mind of the surgeon, to pass a probang down the œsophagus, according to the recommendation of Mr. Samuel Cooper.³

Treatment.—With respect to the method of remedying this accident when it has occurred, and of dispelling its bad effects, there is but one which can be proposed with any confidence, and that is the operation of tracheotomy. No other remedial measure is of the slightest value; the introduction of probangs into the œsophagus, the exhibition of emetics and sternutatories, have all been tried, and have (as far as I can find) invariably failed; whilst tracheotomy, when early performed, and when the extraneous body is in the trachea, has always succeeded.

It is scarcely necessary in the present day to insist upon the advantages of an early operation; when we consider the sensitive

¹ Mem de. l'Academie de Chirurg. tome iv. p 471, 476, and 479, octavo edition.

² Lib. cit. tome iv. p. 446, octavo edition.

³ Surgical Dictionary, art. Bronchotomy.

nature of the membranes lining the air tubes, and especially of that of the glottis, their promptitude in taking on inflammatory action, the disorganization of the lungs that arises from a continued obstruction to respiration, and the very distressing nature of the symptoms before relief is obtained, we cannot hesitate in proposing tracheotomy the instant we have satisfactorily ascertained the nature and the cause of the affection.

The results of the operation, as exhibited in the cases recorded in various medical works, are singularly favourable, and delay in its performance is the only cause that can throw any thing like discredit upon it; for when it is put off too long, laryngitis, extensive bronchitis, emphysema of the lungs, or pneumonia, will have commenced, and may proceed to a fatal issue in spite of the relief from the suffocative symptoms obtained by means of tracheotomy.

The operation should be effectually as well as speedily done; the division of the trachea should be sufficiently extensive to admit of a free exit of the foreign body, and there will seldom be much trouble in searching for the intruder, as in most cases it is forcibly expelled through the wound, often to the height of two or three feet or more.

In three of the cases given by Louis, in his memoir on this subject, the operation was completely successful. In M. de la Martiniere's case instant relief was obtained. Mr. M'Namara's case is another example of the same kind, except that some inflammatory symptoms supervened, which were relieved by appropriate measures: the operation was not done till the third day. Dr. Hunt performed tracheotomy on a boy the day after he had got a pebble into his trachea;¹ immediate relief was obtained when the stone was removed, but in the course of the night laryngitis of an acute character attacked the patient, and required very energetic antiphlogistic treatment: however, it was ultimately subdued. In the volume of the *Lancet* for 1829 a case is narrated in which, by some mischance, a bean fell into the trachea; the operation in question was performed soon after the accident happened, and the bean was instantly driven through the wound, and the patient got well without any unfavourable symptoms. Also in the *Medical Gazette* for 1833 is there a similar case, except that the foreign body was a melon-seed; on opening the trachea the seed was expelled with such force that it flew over the shoulder of the operator. M. Pelletan gives several instances in which he was successful in relieving persons with foreign bodies in their tracheæ, by means of this operation.² In the case of a child who had got a bean into the trachea, this able surgeon performed tracheotomy after four days had elapsed; temporary relief was obtained, but the little patient died convulsed fourteen hours after the operation. M. Dupuytren succeeded in three instances in extracting beans from the tracheæ of children by

¹Medico Chirurgical Transactions, vol. xii. p. 27.

²Clinique Chirurg. tome i.

means of tracheotomy; they were all eventually cured, but two of them suffered severely from acute bronchitis after the operation.¹

From these and other instances of a similar kind we may safely conclude that tracheotomy, when performed soon after the accident, will almost invariably give relief; that when delayed for three or four days it may still afford temporary relief, and even cure; but that the chances of perfect success diminish in proportion to the lapse of time, always supposing the extraneous substance to have been in the trachea; that very little trouble may be anticipated in getting hold of the foreign body, as, in most instances, it is forcibly driven through the wound directly that the trachea is opened. In confirmation of the last conclusion there are some experiments by M. Favier,² in the course of which he introduced a foreign substance of an irregular shape (size not given) into the trachea of a dog; on opening this tube the extraneous body was instantly driven out: it was replaced ten times, with a similar result on each occasion, even though, in some of the repetitions, it was pushed far down into the bronchi. M. Dupuytren remarks that, in case the foreign body does not come out at the moment of the operation, the lips of the wound must be kept open by means of a canula, or by silver or leaden wires. In a case that occurred to himself the bean could not be extracted at the time of opening the trachea, nor was it till the third day that the interne found it upon the dressings. The cure was completed in a short time afterwards.³

Foreign bodies in the bronchi.—The third division of the subject of foreign bodies in the air passages comprises those cases in which the extraneous body, either from its size or from its gravity, falls into the bronchi, giving rise to pectoral disease of a most intense character in many instances, in others inducing the symptoms of chronic catarrh or spasmodic asthma, and terminating either in death or in the expulsion of the foreign body. Dr. John M. Nooth has given an account of his own sufferings from an accident of this description, the history of which I shall venture to abbreviate.⁴ The circumstance of the patient being an intelligent physician and narrating his own case, gives additional interest and increased value to the account. He was seized, whilst on duty at Quebec, with an asthmatic affection that came on almost every day for some months; it consisted of pain and sense of weight in the left side of the chest, together with some difficulty of breathing. A few months after the first seizure there came on, in addition to the other symptoms, intermitting pulse and irregularity of the heart's action. To remove an ague with which Dr. Nooth was also afflicted, he was persuaded to return to England, and two years from the commencement of the series of asthmatic attacks he arrived in London. Soon after his

¹ Leçons Orales, tome iii. p. 586, 593, and 601.

² Mem. de l'Académie de Chirurg. tome v. p. 356, octavo edition.

³ Leçons Orales, tome iii. p. 601.

⁴ Transactions of the Medical and Chirurgical Society, vol. iii., p. 1.

arrival he went to the theatre, the house was crowded and very hot; his cough became unusually severe, his respiration difficult, and the irregularity of the heart's action much greater than ever. Under these circumstances he went home, and retired to bed very ill and in great distress. Lying with his face downwards he continued coughing and spitting phlegm, and towards morning he discovered that he had spit up a large leaden shot, about an eighth of an inch in diameter. In ten or twelve days afterwards the expectoration and cough had quite ceased, and the pulse had become regular. Dr. Nooth could not be certain how this shot got into the air passages, but he remembered that he was one day seized, immediately after drinking the last glass of a bottle of wine, with a convulsive cough, which continued to be troublesome for some days after, and this was previous to his experiencing any uneasiness in the chest.

There can be no doubt that the shot expectorated had been lodged in one of the ramifications of the left bronchus, and that the train of distressing symptoms was owing to the irritation kept up by this extraneous body on the mucous lining of the air passages. The difference in the effects produced by the lodgment of a foreign body in the trachea and in the bronchus is very striking: in the latter case there are no attacks of approaching suffocation, no convulsive cough, except for a short time after the body has irritated the glottis by its passage through; but its presence causes occasional dyspnœa, by obstructing some of the bronchial tubes, and thus diminishing the extent of the internal surface of the lungs by which respiration is performed; and it also, in time, gives rise to inflammation of the mucous membrane, and, as a consequence of this, to excessive mucous purulent secretion, emaciation, and death. An instance that well illustrates these latter effects is quoted by Louis in his memoir, to which reference has been before made; it is taken from the *Ephémérides des Curieux de la Nature*.¹

An elderly monk, whilst eating a cherry, was suddenly called to his religious duties; the cherry-stone slipped into the trachea, producing violent cough and great efforts at vomiting, of which he was near dying. A sleep of some hours succeeded to this terrible agitation, and the patient felt no more ill effects for a whole year. At the end of this time he was attacked by cough, accompanied with febrile symptoms: these became more severe daily, till at length the patient rejected a stone of the size of a nutmeg. It was formed externally of a tartareous matter, to which the cherry-stone served as a nucleus. A copious purulent expectoration followed the expulsion of this foreign body, and the patient died a few days afterwards in a state of marasmus.

The most curious circumstance in the history of this case is the length of time that the cherry-stone remained, to all appearance, harmless within the air tubes. It must be accounted for, in a

¹Decad. 2, an 10, p. 123.

great measure, by the deficiency of natural sensibility in the bronchial membrane; at the same time, from the rapidity with which the patient sank after the expulsion of the extraneous substance, we may conclude that considerable mischief had been going on in the neighbourhood of the cherry-stone, that an abscess had formed within the lung, and that the removal of the foreign body allowed the escape of the pus which the abscess contained.

Many instances might be cited to prove that when a foreign substance gets quietly seated in either bronchus, little disturbance in the pulmonary functions ensues for some time, till inflammation of the mucous membrane, or of the tissue of the lungs sets in, and then the effects are very violent, and, when the latter structure is involved, generally fatal. In Mr. M'Namara's second case,¹ a plum-stone had slipped into the trachea, and produced the usual effects—dyspnœa, suffocative cough, &c. An incision was made into the larynx and trachea, an inch in length. Perfect relief from all the distressing symptoms was the result, and the surgeon concluded that the stone had been impelled into the pharynx and swallowed. The only trouble the patient experienced was lest he should not regain his voice. Nothing remarkable occurred in this case for eight days; purgative medicine was administered, and the stools were examined in the hope of finding the plum-stone, but the search was unavailing. About the end of this time, Mr. M'Namara, happening to examine the chest with a stethoscope, was surprised to find a nullity of respiration on the right side, although the chest on this side sounded clear on percussion, whilst on the other side respiration was more energetic than natural. From these circumstances he concluded that the stone was in the right bronchus—a situation which, happily, it did not occupy long, for in a few minutes he could hear in the trachea that peculiar "*ronflement*" which is so indicative of a foreign body moving in that tube. The wound in the trachea was enlarged downwards half an inch, when the stone was forced out in a fit of coughing. The patient was quite well in six days after.

This case is interesting in two points of view: 1st. as showing the use of the stethoscope as a means of diagnosis; and 2dly, as exhibiting the little degree of disturbance that ensues when the extraneous substance becomes quietly fixed in the bronchus. With regard to the utility of the stethoscope, I know not what exact value is to be placed on the hearing of "that peculiar *ronflement*" which the narrator of the case mentions as so indicative of the presence of a foreign body in the trachea, but no one at all accustomed to the use of the instrument could be deceived as to the deficiency of respiration on one side of the chest. Therefore, assuming that the plum-stone was located in the bronchus, we may remark how completely free from cough and dyspnœa the patient was during the eight days that it occupied this situation.

¹ Dublin Hospital Reports, vol. v. p. 590.

There are many reasons for believing, however, that though the immediate effects of a foreign body falling into the bronchus may be trifling and almost unobservable, it cannot occupy this situation long without inducing the most formidable consequences. M. Lescure, in his paper on this subject, to which reference has been made before, gives two examples that are illustrative of this point.¹ A soldier, whilst sucking a marrow-bone, was seized with a violent cough, pains in the left side of the chest, and spitting of blood. For these complaints he was bled, and after a little while was sufficiently recovered to join his regiment. Nine months after the first attack of illness he began to complain of difficulty of breathing and a troublesome cough, with which he expectorated a great quantity of ash-coloured pus, having a very fetid odour. A month afterwards, during a severe fit of coughing, he rejected a portion of bone of a triangular figure, and immediately he lost the pain in the chest, and his respiration and cough became easier: in spite of these favourable appearances the soldier died three days afterwards. At the opening of his body the right lung was found in a natural state; the left was gangrenous; and in the left bronchus, four inches from the bifurcation of the trachea, there was an unnatural cavity capable of containing a large nutmeg, in which the bone had probably sojourned for a period of ten months.

The other instance is that of a man, who, in pretending to throw a louis d'or down his throat, loosed it unintentionally, and it fell into the trachea. He survived this accident nearly six years, but was never free for long together from cough and dyspnoea. On examining the body after death the right lung was entirely destroyed by suppuration, the right cavity of the chest was full of pus, and the louis was found placed perpendicularly to the upper part of the right lung, at the first division of the bronchus on this side.

In the *Lancet*,² we find a case somewhat similar, except as to the result. A man, aged thirty-five, was talking to a person on the 6th of April, whilst at the same time he held a sixpence between his teeth. In the act of speaking, the piece of money passed into the trachea. At first he was nearly suffocated on the spot; but in a few moments the respiration became easier, and for some days he complained only of a soreness across the chest and a disposition to cough, for which he was bled with relief. The inflammatory symptoms recurred, however, and it was thought necessary to extract the sixpence if possible. For this purpose the trachea was freely divided, and a probe was passed upwards and downwards without encountering the object of research. The operation was productive of no further inconvenience to the patient, and the wound rapidly cicatrised. After the lapse of nearly four months, Mr. Key was consulted, and from an attentive review of the case, together with an examination of the relative size and direction of

¹Mem. de l'Académie de Chirurg., tome v.

²Vol. for 1828—9, p. 661.

the two bronchi, he came to the conclusion that the sixpence was in the right bronchus, and that it might probably be removed by an operation. Experiments on the dead body showed that a sixpence would pass down the right bronchus to the distance of an inch, and that it might be extracted with facility.

The operation was performed on the 6th of August; but the moment that the trachea was opened the patient fell into a state of syncope, succeeded by apoplectic symptoms, and expired in about an hour. It was remarked that while respiration was being performed with great difficulty, the left side of the chest only seemed to be distended, the right continuing almost motionless.

A post-mortem examination took place on the following day, and Mr. Key finished speedily and successfully, on the dead body, the operation which he had commenced on the living. The sixpence was removed after a few attempts without much difficulty. There was no effused blood in the trachea; the lining membrane of the right bronchus was thickened and ulcerated at the point where the foreign body had been situated, and the upper third of both lungs appeared to have suffered from repeated attacks of inflammation, the minute ramifications of the bronchial tubes being glued together. The lower portions of the lungs were quite healthy.

These instances are sufficient to show the dreadful consequences of this accident when the body in the bronchus is of such a nature that it cannot be expelled by the act of coughing; the angular form of the bone in the first case, and the weight of the louis and of the sixpence in the others, being almost insuperable bars to such a happy consummation. Many instances might be cited where bodies of a different form have been expelled by coughing, and where immediate relief and ultimate cure have been the results; but it is useless to multiply facts, and perhaps the case of Dr. Nooth is as good an example of this kind of termination as could be found. There is always a difficulty in proving that, in such instances, the foreign substance has been in the bronchi: the circumstance that conduces most strongly to such a belief is an immediate and marked improvement in the bronchial symptoms upon the rejection of any extraneous substance by coughing.

The remission of the cough and the sense of impending suffocation, when the extraneous body becomes fixed in one of the bronchi, though it is most frequently observed, is not a constant sign. Dr. Webster was called to a boy, aged fourteen, who had accidentally got a broken cherry-stone into the air passages twelve days before.¹ Violent fits of coughing, difficulty of breathing, and a sense of instant suffocation, had continued, without intermission, from the time of the occurrence of the accident. The stethoscope indicated that the left lung was collapsed, but sound, whilst on the right side every thing seemed healthy. There was a continual darting pain under the sternum, extending towards the left side,

¹ London Medical and Physical Journal, vol. lvi. p. 430.

and constant palpitation of the heart. Dr. Webster concluded that the foreign body was situated in the left bronchus. Bleeding from the arm, leeches, and blisters, were resorted to with considerable benefit; but ultimately the patient became very weak and exhausted, the pulse was constantly quick, and he had slight shiverings, indicating the formation of matter. On the sixty-eighth day, after violent fits of coughing, a pint of fetid pus, mixed with streaks of red blood, was expectorated, and in the midst of which was found the broken cherry-stone. From the time the stone was expelled the patient gradually recovered, and in three weeks afterwards was perfectly convalescent.

Diagnosis.—The diagnosis in this last class of cases is more difficult than in either of the foregoing ones; in fact, we must rely almost entirely upon the patient's recollection of his own sensations. The symptoms that result from this accident are, in the first instance, a violent spasmodic cough, caused by the passing of the foreign body through the glottis; afterwards an interval of ease, varying considerably as to length; in the sequel pain in the chest, cough, and mucous or purulent expectoration. It is evident that there is nothing characteristic in this train of symptoms; the violent cough that occurs at the onset would, in most cases, be overlooked or forgotten during the period of ease that so soon follows, and the bronchial disturbance would, in all probability, be attributed to the effects of cold. Unless, therefore, the patient has a distinct recollection, or strong grounds for suspecting, that a foreign body has passed through the larynx, it would be next to impossible to arrive at the true cause of the affection under which he is labouring. When a foreign substance is supposed to have located itself in either of the bronchi, the stethoscope will afford valuable assistance, by enabling us to ascertain if one of the lungs, or any considerable portion of it, is impervious to air during respiration. The use of this instrument and a most minute examination into the details of the history of the case are, I fear, the chief circumstances upon which we can hope to found our diagnosis, and they, unfortunately, afford but very doubtful evidence. The existence of a dull fixed pain on one side of the chest more than the other, together with the indications that auscultation and percussion are capable of giving, would be sufficient to decide in which of the bronchi the foreign body was situated, if, from other circumstances, we had come to the conclusion that this accident had occurred.

Treatment.—We have next to consider what remedial measures can be adopted for the relief of a person in whose bronchus a foreign body has become lodged. In the first place it is highly important to acquaint ourselves with the qualities of the body, its form, size, and weight particularly; that we may judge of the possibility of extracting it by an operation, or of the probability of its being driven from its situation by the expulsive power of the muscles of respiration.

With respect to the natural termination, I mean the rejection of

the extraneous substance by the mouth, we have seen, in the foregoing pages, that this occasionally happens, and that it may be followed by perfect relief, as in the cases of Dr. Nooth and the boy attended by Dr. Webster ; but, in the majority of instances that I have met with, the lesions produced by the continued residence of the foreign body within the brouchus are of so serious a nature, that temporary benefit of the most transient description can alone be anticipated. It appears probable that, in some of the cases, the foreign body was indebted for its release to the progress of the pectoral disease ; for in what other way can we account for its being expelled in the instance of the soldier, where the lung was in a state of gangrene, and consequently impervious to air, and in whom the expelling force could not, on this account have been very great? In the case of the man who had got a sixpence into the right bronchus, the post-mortem examination showed that the lining membrane was beginning to ulcerate in the situation that the piece of money had occupied ; and though, in time, the ulceration might have extended sufficiently to have allowed the sixpence to be rejected, the hepatisation of the lung, which had already commenced, would, in all probability, have made such progress in that time, as ultimately to have led to a fatal termination. In proportion to the length of time that the extraneous body has continued in its unnatural situation, will the chances of a successful result on its expulsion be diminished ; for it cannot remain in the bronchus, or in any of its ramifications, without acting as a source of irritation and of inflammatory action. *

When, owing to the size or shape of the foreign substance, there is no probability of our being able to remove it by an operation, we must content ourselves with the adoption of such means as will tend to prevent inflammation, or to subdue it if it should take place. The abstinence from stimulating food and drink, and from violent exertion of any kind, form the most natural mode of pursuing the first object ; and the second must be accomplished by general and local bleeding, antimonial medicines, &c. ; in short, by such measures as we should have recourse to if the inflammatory affection of the chest arose from any other cause.

The only question that remains for consideration is, whether there are any circumstances that would justify our attempting to extract a foreign body from the bronchi by means of instruments. I have already given a short account of one case, in which Mr. Key tried to remove a sixpence from the right bronchus, and which, although the attempt was unsuccessful, did not appear to have owed its fatal termination to any thing directly connected with the operation. A fairer case for the experiment than this could not, perhaps, have been selected ; a flat, circular body, situated in the larger and more direct of the bronchi, offered as great facilities as could be met with in any instance ; nor is there much reason to doubt that the operation would have been attended with success if death had not occurred in so unexpected a manner.

Mr. Liston succeeded in extracting a piece of bone from the right bronchus, after it had been fixed in that situation more than six months.¹ The patient, a woman, aged thirty-seven, was seized with convulsive cough on the entrance of the bone into the larynx; the cough lasted two or three minutes, and then ceased entirely. She was afterwards subject to attacks of dyspnoea and severe cough, which came on frequently and were succeeded by intermissions of variable length. Mr. Liston, from an investigation of the symptoms was convinced that the foreign body still remained, and that, from the greater size of the right bronchus, and the more obtuse angle formed by it with the trachea, the bone was situated in this tube. The usual operation of tracheotomy was performed; a gunshot probe was then passed down to the right bronchus, and the bone was immediately struck. After one or two unsuccessful attempts the foreign body was extracted. The passing of the instruments produced violent fits of coughing, with heaving of the chest and lividity of the face. The removal of the bone gave instantaneous relief, and the respiration became calm. In nine days after the operation, the wound was quite healed, and the woman left the hospital as well, in every respect, as she had been before the accident. The blades of the forceps that were successfully used were slightly curved in the direction of the handles, and the whole instrument was seven inches long. The piece of bone was flat, of a triangular form, and the greatest side was about an inch in length.

Both in the above instance and in Mr. Key's case, the patient was an adult, and this circumstance was favourable for the operation; for, previous to the age of puberty, the size of the trachea is comparatively so small that it would be a matter of great difficulty to move a pair of forceps about in this tube with sufficient freedom for seizing a foreign body in the bronchus. Mr. Porter recommends that, in cases where this operation is attempted, after the situation of the foreign body has been ascertained by passing a probe through the divided trachea, "a large portion should be cut from the front of the tube, in order to allow the hinge of the forceps to play with freedom."²

Besides the age of the patient, the shape of the extraneous body is almost the only circumstance that we need take into our consideration when deciding upon the practicability of its extraction from the bronchus. It would be useless to attempt the removal of a body of a spherical form, or of one that even approached that kind of figure; for, whatever might be its size, if it were impacted in the bronchus, it could be retained there only by undergoing a degree of constriction from the pressure of the sides of the vessel, and consequently any attempt to grasp it by forceps would endanger the continuity of the tube. Bodies that are flat at their sides and tolerably regular at their edges, like pieces of coin, certainly

¹ *Lancet*, June 14, 1834.

² *Lib. cit.* p. 218.

offer greater facilities for extraction than any others; they are almost sure to fall with their flat surfaces in the direction of the sides of the tube, on account of the smaller degree of resistance they would encounter in their passage in this manner. For this reason there is plenty of room to introduce the blades of the forceps on both sides of the body, and when once grasped, very little difficulty need be anticipated in drawing it forth. A flat body of the description just mentioned is of all others the least likely to be removed by natural means, as its edges would present so slight a surface for the air in expiration to act upon. Taking into consideration, therefore, the extreme improbability of a natural cure, the certainty of a fatal result if the foreign body be not removed, and the possibility of its extraction, we must come to the conclusion, I think, that in the event of a body of the form last described getting impacted in the bronchus, it would behove the surgeon to attempt the relief of the sufferer by means of an operation. The operation would consist in an ample division of the trachea, and afterwards in the introduction of a pair of forceps, the blades of which should be long, slender, and slightly curved; and perhaps if the handles were placed at an obtuse angle with the blades, the grasping of the foreign body would be facilitated.

CHAPTER XVIII.

BRONCHOTOMY.

An operation which consists in the perforation, by a cutting instrument, of some part of the track of the larynx or trachea, appears first to have been thought of and recommended by Asclepiades, the restorer of medicine in Rome, as a remedial measure in those species of quinsys in which there was great danger of suffocation. Much opposition was evidently excited at the time by this novel mode of procedure, as we may judge by the remarks upon the subject in the works of Cælius Aurelianus, Celsus, and Aretæus. From an observation by the last of these authors, we may infer, however, that the operation was occasionally performed, and performed with success; for, after speaking of the evil consequences likely to result from it, he remarks that "if some patients have escaped from the perils of the operation, the lips of the wound can never become consolidated," &c. The operation seems to have maintained some degree of reputation till the time of the fall of learning. The great Arab physicians, Rhasis, Albucasis, and Avenzoar, never performed it from fear for the result; and at the revival of letters the opinions of the Arabs continued for some time predominant. At the commencement of the seventeenth century, advocates in favour of bronchotomy sprung up in Casserius, Fabricius ab Aquapendente, and Habicot, a Parisian surgeon; and from

this time the operation seems never to have been lost sight of, till the admirable papers of Louis, in the fourth volume of the *Memoirs of the French Academy of Surgery*, fully established its claims to public confidence.¹

I have had frequent occasion, in the preceding chapters, to allude to the operation of bronchotomy; and I shall now proceed to consider more fully, 1st, the mode of performing it; 2d, the difficulties and dangers attending it; 3d, the peculiar accidents and diseased conditions this operation is best fitted to remedy or relieve; and, lastly, the causes to which its frequent failures are to be attributed.

The word *bronchotomy* is used as a general term, comprehending the two similar operations, *laryngotomy* and *tracheotomy*. The former of these is not performed so often as the latter, because its powers of affording relief are of a much more limited description: when, however, the case is of such a nature that both operations may be equally serviceable, the former should always be preferred, on account of its greater facility of accomplishment and its comparative freedom from danger.

Laryngotomy consists in effecting an opening into the larynx through the crico-thyroid membrane, in that triangular space existing between the lower margin of the thyroid and the upper margin of the cricoid cartilages. An incision of an inch in length is made through the integuments along the central line of the neck, just over the crico-thyroid space; the edges of the wound are then separated, and the incision is continued down to the membrane, which, upon being exposed, may either be punctured with a trocar, or divided in a transverse direction with the scalpel. If the disease for the relief of which the operation has been done, requires that the artificial opening be maintained for some time, it will be necessary to introduce a canula through the wound and confine it there by bandages, as the irritation produced by it will cause strong expulsive efforts on the part of the patient; but if the disease is of a temporary nature, it will suffice to cut away a portion of the crico-thyroid membrane.

No untoward event, no embarrassment of any kind, is to be expected in the accomplishment of this operation; the situation of the parts is superficial, and there is but little risk of hemorrhage; the only vessel at all likely to be divided is the small crico-thyroid artery, which ramifies upon the membrane of that name; but its size is so inconsiderable, and its inosculations so unimportant, that the bleeding will soon cease without using a ligature. *Laryngotomy* is more suited to adult males than to any other class of persons, because the larynx is lower in the neck, and its dimensions larger, and consequently the crico-thyroid space more ample, in them than in women or children.

¹ To these papers I am entirely indebted for the slight sketch I have attempted to give of the history of this operation.

Tracheotomy is not performed with so much facility as the foregoing operation, though, on ordinary occasions, when no great tumefaction of the neck or distension of its veins exists, we need not anticipate any serious difficulties. The patient is to be placed on a bed or sofa, with his head thrown as far back as he can well bear it without inducing a tendency to suffocation: this position throws the windpipe prominently forward, and renders the integuments and muscles in front of it conveniently tense. An incision must then be commenced over the cricoid cartilage and continued downwards, precisely along the central line of the neck, to the extent of about two inches; the edges of the wound are next to be drawn asunder, and the surface beneath must be carefully examined, in order to detect any vessels that may be exposed; and if such exist they must be withdrawn from the track of the knife. The incision is then to be continued between the sterno-hyoid muscles, down to the fascia which immediately covers the trachea. This fascia must be carefully divided, the bottom of the wound examined, and, if no vessels present themselves, the trachea may be divided, from below upwards, to the extent of half an inch or more, by means of a probe-pointed bistoury.

The object for which the operation is undertaken must regulate the succeeding steps; for instance, if it be for the removal of any extraneous substance from the air tubes, it will be advisable to make a transverse incision on either side of the longitudinal one, between the two rings of the trachea that are nearest the centre of the wound; and, moreover, immediately that the operation is concluded, the chin of the patient should be brought nearer to his breast, by which means the artificial aperture in the windpipe will be expanded, and will allow a readier egress for the foreign body.¹ If tracheotomy be performed for the relief of acute disease in the larynx—disease which, though severe, may be expected to be transient—an oval piece, larger than is absolutely necessary to enable the process of respiration to go on, must be cut out of the front of the trachea, and the edges of the wound in the integuments must be kept asunder by means of ligatures or pieces of wire. But if this operation be undertaken for chronic laryngitis, or for any form of disease in which the obstruction to respiration has been slowly produced and is likely to remain for some time, it will be proper to introduce a canula into the trachea, and to maintain it there by means of a bandage round the neck. This proceeding, which was first proposed by Fabricius ab Aquapendente, has often been adopted with advantage: at the same time, in consequence of the inconvenience that results from its use, many authors are willing to discard it altogether. Mr. Carmichael objects to the introduction of a canula, on account of the great distress produced by its use, and also because he considers the removal of a piece of the trachea more

¹ *Leçons Orales, de Dupuytren, tome iii.*⁶p. 592.

efficacious in allowing easy egress to the mucus.¹ Pelletan,² in like manner, prefers dividing several of the tracheal rings to the use of the canula; the presence of which, he says, is insupportable to the patient, and can only add to the irritation already existing. Mr. Porter recommends the introduction of a canula immediately after puncturing the trachea, in order to prevent any blood from getting into the air passages; "besides," says he, "the objection that the canula causes irritation is not valid with respect to the trachea. * * The sensibility of the lining membrane is much inferior to that of the larynx, and a canula can be easily endured in the former for the first thirty-six or forty-eight hours after the operation."³ Mr. Lawrence recommends that a short flattened canula be introduced; but if it cannot be borne, he advises the removal of a thin slip of the trachea, so as to leave an artificial opening for respiration, equal in size to the natural one.⁴

The removal of another portion of the front of the trachea is by no means unattended with inconvenience. For, in the first place, when the operation is performed at the lower part of the neck, the distance between the surface of the integuments and the trachea is so great, that it becomes a matter of considerable difficulty to cut away an elliptical portion of this tube. The difficulty amounts almost to an impossibility when the integuments are much tumefied either by emphysema or by serous or purulent infiltration. This step of the operation is, however, greatly facilitated by drawing forward the trachea by means of a hook inserted underneath one of its cartilaginous rings. In the second place, the removal of a portion of the front of the windpipe, especially in children, may probably occasion a narrowing of the tube at this part to such an extent as subsequently to interfere with the functions of the organ. The area of the tube is, in the natural condition of the parts, preserved by the elasticity of the cartilaginous rings, which counteract the disposition of the muscular bands at the back to diminish its calibre. But when the centre of two or three of the rings is removed to any extent, the action of the muscular fibres remains uncontrolled, and the trachea becomes in consequence very much narrowed.⁵

In coming to a determination on the question of using a canula, it is very important to consider the nature of the disease for the relief of which tracheotomy has been performed, the duration of the disease, and the probabilities of an ultimate cure. There are many cases on record, to two or three of which I have referred in article Chronic Laryngitis, where it has been found necessary to preserve the artificial opening during the whole of the subsequent life; in

¹ Transactions of King's and Queen's Colleges, vol. iii. p. 175.

² Clinique Chirurgicale, tome i. p. 31.

³ Pathology of the Larynx, p. 263.

⁴ Medico-Chirurgical Transactions, vol. vi. p. 249.

⁵ For an illustration of this point, see the Lancet for March 19, 1836.

such cases the constant use of a canula is indispensable, for the aperture made by the operation, even when the rings of the trachea have been freely cut away, has so strong a tendency to close, that nothing else will secure the patient from the suffocation he has already undergone so much to avoid. Mr. Wood, in his paper "On Bronchotomy," &c.,¹ speaks of a preparation, in the Anatomical Museum of St. Bartholomew's of the larynx and trachea of a man who underwent bronchotomy, and wore a tube for several years afterwards; the rima glottidis is much narrowed by thickening of the membrane covering the cordæ vocales. This is an instance of the kind of cases that would demand the continual use of a canula. A slowly increasing morbid deposition in the mucous texture—though probably it would never completely close the aperture of the glottis—might, nevertheless, contract it so much as to render the supply of air too small for the purposes of life. Tracheotomy is necessary to save the patient from suffocation; but this operation is not a cure for the original disease; and unless this be removed by appropriate treatment, it will be necessary during the remainder of life to maintain the artificial opening in the trachea. This can only be done by means of a canula; for the natural disposition of the wound to close is so strong, that even the utmost care and attention will not prevent it, unless a tube be constantly worn. In Dr. Latham's case, contained in Mr. Lawrence's paper before referred to,² the same object was attempted to be accomplished by an instrument of a flattened figure, consisting of two branches connected by a hinge, and which could be separated or approximated by means of a screw; but the termination of the case was unfavourable; and, after six weeks of misery, the patient died suffocated from the accumulation of mucus in the artificial opening. In cases of chronic laryngitis attended with interstitial deposition about the rima glottidis, we must, I think, come to the conclusion that it will be necessary to provide for the continuance of respiration by the introduction of a canula.

The shape of the canula is a matter of some consequence; it should be as short as possible, providing that it will maintain its situation in the trachea during the respiratory movements. The one proposed by Casserius, and which is figured in the fourth volume of the *Memoires de l'Académie de Chirurgie* (pl. iv. fig. 2), is curved, and its lower part, intended to be introduced into the trachea, is pierced with several holes; there are rings at the sides for the attachment of ribands, which pass round the neck and confine the canula in its situation.

I have not met with any description of the canulæ that have been used by surgeons on these occasions; but of course the less they come in contact with the mucous membrane of the trachea the better; the slighter the obstacle they present to the passage of the

¹ Medico-Chirurgical Transactions, vol. xvii. p. 194.

² Ibid, vol. vi. p. 257.

air and the exit of the mucus, the more easily will they be borne; and, therefore, a tube with a sufficient calibre to allow an abundant supply of air, completely open at both ends, and curved enough to permit the lower extremity to pass downwards in the direction of the axis of the trachea, whilst the upper one, surrounded by a projecting lip, shall be on an exact level with the integuments of the neck, seems to me best adapted to fulfil the desired objects.

It is but just to state, in conclusion, that almost every writer on the subject of bronchotomy repudiates the use of the canula; yet as there are many cases recorded by practical men, in which this instrument has been necessarily used for a long course of years, I have thought it right to consider its most appropriate form, and to uphold the advantages occasionally resulting from its adoption.

I have next to speak of the dangers and difficulties attending the operation of tracheotomy. The only *dangerous* occurrence in the performance of this operation is that of hemorrhage into the trachea, which may produce immediate suffocation. This seems to have happened in the case of a young man upon whom the operation of laryngotomy was performed, by M. Roux, for the cure of chronic laryngitis. Directly that this accomplished surgeon had opened the larynx, by dividing the crico-thyroid membrane, the patient made strong expiratory efforts, and ejected some frothy blood from the wound. Suddenly respiration was suspended, and the patient died from the flow of blood into the trachea.¹ In another instance, in which tracheotomy was performed by the same surgeon, to prevent suffocation in a case of chronic laryngitis, a similar event was on the point of happening, but was avoided by the energetic conduct of the operator. Scarcely had the trachea been opened, says M. Andral,² when a small quantity of blood penetrated into this canal at the moment of inspiration. Its presence hindering the air from getting into the ramifications of the bronchi, the patient fell down senseless; respiration was interrupted, and the beating of the heart could no longer be felt. Far from being disconcerted at this occurrence, M. Roux introduced a gum-elastic sound into the trachea, and by reiterated aspirations managed to suck up part of the blood which formed the obstacle to the passage of the air. By these means the respiration and circulation were again restored, but for two days the patient remained senseless, although ultimately he recovered both from the operation and from the disease for the relief of which it had been performed. In a case where the operation was performed very recently by my friend Mr. Amphlett, of Birmingham, the patient was apparently suffocated by the flowing of a small quantity of blood into the trachea; artificial respiration was immediately resorted to, and the patient, after coughing up a clot of blood, completely revived and lived many hours, though the result of the case was ultimately unfortunate.

¹ Archives Gen. de Médecine, December, 1831.

² Clinique Medicale, tome ii. p. 215.

To avoid the danger of blood getting into the trachea, it is advisable to wait, after this tube has been exposed by an incision, till the hemorrhage either ceases of itself or has been arrested by appropriate measures. It seldom happens that the time occupied by this delay can be of such vital consequence as to tempt one to open the trachea when the neighbouring vessels are pouring out blood; but occasionally the risk of suffocation will demand that the operation be proceeded with in spite of any thing; and in such cases we must trust to the adoption of such a posture for the patient as will be likely to cause the blood to take a direction from the tracheal aperture. In an operation of this kind, performed by Virgili, where the blood flowed through the incision into the windpipe, he enlarged the wound, and then, by a suitable posture, caused the effused blood to run out again.¹ Desault, on one occasion, attempted to perform tracheotomy on a child into whose trachea a bean had fallen, but the first incision was followed by such a flow of blood that he was obliged to defer the opening of the trachea for two hours, and in the interval the child died.² Unfortunately we are not informed whether death occurred from hemorrhage or from suffocation, but most probably it was from the latter cause. As a general rule, suffocation should be avoided at all hazards; and in many instances it has happened that venous hemorrhage has ceased when the trachea has been opened, on account of the relief afforded to the turgid veins of the neck by the restoration of free breathing, and consequently of an unimpeded circulation of the blood.

Hemorrhage may occur externally to an extent sufficient for the destruction of life; but this can arise only from extreme carelessness or from some very extraordinary distribution of the arteries; to the former cause we must attribute the death of the student mentioned in Desault's *Œuvres Chirurgicales*; ³ in this case a friend attempted to perform tracheotomy, but the trachea, not being well steadied, slipped aside and the knife entered the carotid artery.

Many varieties have been observed in the giving off and the distribution of the arteries about the lower part of the neck; there may be a middle thyroid artery running up the front of the trachea, and which, if not observed, must be inevitably wounded in the performance of the operation in question. Mr. Burns, in his valuable work *On the Surgical Anatomy of the Head and Neck*, speaks of several other unusual distributions of the thyroid and carotid arteries which it would be useless to particularise; and, with reference to tracheotomy, he observes that these varieties in the course of the arteries show the impropriety of using the knife further than merely to divide the integuments and fasciæ, and that the trachea may then be cleared by the finger and thus all danger of injuring the large arteries will be avoided.⁴

¹ *Œuvres Chirurg. de Desault*, tome ii. p. 262.

² *Idem*, tome ii. p. 250.

³ *Par Bichat*, tome ii. p. 273.

⁴ *Op. cit.* p. 416.

The veins in the front of the neck furnish another source from which hemorrhage may take place to a considerable amount, and this species of bleeding is far more common and fully as difficult to control as that from the arteries. The thyroid veins are generally out of the reach of the knife, but in many subjects the inferior thyroid veins, after quitting the gland, anastomose with each other and with the superior thyroid veins, forming a venous plexus in front of the trachea, which may be exceedingly troublesome to the operator. In the same way the external jugulars, when they follow their usual course, cross the direction of the sterno-mastoid muscles, and empty themselves into the subclavian vein external to those muscles; but it often happens that a large branch is given off from the external jugular on each side, and that the two unite at the lower part of the neck, just above the sternum.¹ If either of these unusual distributions of the veins are observed, extreme care will be necessary to avoid wounding them, and the vessels must be drawn aside by an assistant with a hook or a bent probe. It must be remembered, that, when the respiration is obstructed to a great degree, the veins in the vicinity of the heart are gorged with blood and distended to their utmost; and we are told that even the vena innominata is sometimes in danger when tracheotomy is performed during the existence of a suffocative paroxysm. It is very improbable that this vein should ever rise above the level of the sternum; and if it does, it will still be protected by the interclavicular ligament.

A curved trocar has been invented, I believe by M. Lisfranc, for obviating the danger of hemorrhage into the trachea during the performance of tracheotomy. The instrument consists of a canula sufficiently large for all the purposes of respiration, and curved in such a manner that the lower portion will pass down the axis of the trachea, whilst the upper part, guarded by a shield, remains on a level with the integuments. The trocar is jointed, so that it can readily be withdrawn after the canula has been made to enter the windpipe. When it is determined to use this instrument, the trachea should first be laid bare in the usual manner, the elastic membrane of this tube should then be divided by a bistoury between two of the rings, and the trocar enclosed in the canula is next to be introduced through the aperture which has just been made. The trocar must be withdrawn immediately that the canula has entered the trachea, and the latter may then be pushed downwards till its shield is in contact with the integuments, and in this situation it may be confined by a bandage. I have never seen the instrument used, but it appears to be capable of preventing the flow of blood into the trachea, which is one of the most serious risks attendant upon the performance of tracheotomy in the ordinary method.

The operation of tracheotomy may be rendered *difficult* by several causes—as by an unusual distribution of the arteries or

¹ Porter, op. cit. p. 250.

veins in the front of the neck; by a considerable degree of enbonpoint in the throat, and by a small development of the trachea—circumstances likely to coexist in young persons; by the large size of the thyroid gland, and especially of the isthmus or middle lobe of this gland; by glandular swellings, by emphysema, or by purulent accumulation in the anterior regions of the neck. The occurrence of any of these complications, or of a union of two or three of them, necessarily adds very much to the difficulties of an operation which, under ordinary circumstances, demands much sang froid and a certain habitual dexterity in those who undertake it.

With respect to the first of these causes of difficulty, I have already spoken sufficiently. The probability of an unusual distribution of the blood vessels, or an excessive distention of them, the result of impeded respiration, requires a most cautious line of conduct on the part of the operator; and I can only repeat the advice of Allan Burns, to use the knife as little as possible after the first incision has been made, and to expose the trachea by means of the finger; for by so doing we shall very much avoid the danger of hemorrhage into the air tubes, and the delay and confusion that result from a flow of blood over the parts to be divided.

The remaining causes of difficulty all act in a similar manner, viz. by increasing the distance between the surface of the skin and the trachea. The natural obesity of children has the effect of interposing a considerable layer of fat between the skin and the wind-pipe; and the comparatively small size of the tube in such subjects renders the operation in them very difficult of accomplishment. On one occasion a surgeon attempted to perform tracheotomy on a child, but was obliged to give it up, as he absolutely could not find the trachea.¹ It is very easy to conceive how much any morbid development of the thyroid gland must add to the ordinary hazards of this operation; and sometimes the lateral lobes are found encroaching very much upon the sides of the trachea, and in other instances the isthmus or connecting slip of this gland is thick and broad. A wound of the lateral lobes is attended with profuse hemorrhage, but the isthmus may be divided in its centre without much loss of blood, the anastomosing vessels being small and unimportant.

When the cellular tissue in front of the neck is in an emphysematous condition, or is infiltrated with serum or with pus, the space intervening between the external surface and the trachea is rendered very great, and the difficulty in performing the operation is much aggravated. Mr. Porter,² in a case of chronic laryngitis attended with emphysema of the neck, cut to the depth of more than an inch and a half before discovering the trachea, and had then great difficulty in fixing it with sufficient steadiness to enable him to make an opening into it. In a patient on whom Mr. McNamara operated,³ serous infiltration of the neck had taken place to such a

¹ Porter, p. 260.

² Dublin Hospital Reports, vol. v. p. 550.

³ Lancet for 1830—1, p. 269.

degree that the trachea was found two inches and a half below the level of the skin.

One very important means towards the efficient performance of tracheotomy consists in having the incision exactly in the middle line of the neck, and in continuing it precisely in the same direction down to the trachea. On this account great care is requisite on the part of the assistants of the operator, that, in separating the lips of the wound, they do not draw them too much to either side, lest they may cause a want of correspondence between the external incision and the aperture in the trachea, which would be almost fatal to the success of the operation. Another important thing is, to make the incision of all the parts superjacent to the trachea sufficiently free and extensive, that there may be plenty of space for the succeeding steps of the operation, and that the motion of the windpipe upwards and downwards, which occurs in excited respiration, may not occasionally carry the artificial aperture in the trachea beneath the contiguous soft parts. I need scarcely add that, when emphysema or serous infiltration of the neck exists, an attention to both these circumstances is more than usually necessary. The fixing of the trachea, previous to its being opened, is sometimes a matter of great difficulty, when the wound in the integuments is very deep; perhaps, in such cases, it would be advisable to make the incision through the rings of the trachea from above downwards, instead of making it in the contrary direction, as is usually done; because, in the first place, the wound is of less depth at its upper part, and in the second place, we have a greater facility in steadying the trachea by pressing the finger upwards against the cricoid cartilage.

I shall next point out, in a cursory manner, the diseases and accidents that the operation of bronchotomy is capable of relieving; and this part of the subject will not detain me long, as I have already taken occasion to speak upon it during the preceding parts of this work. The general uses of bronchotomy may be summed up in few words; it is practised to relieve impeded respiration arising from any cause that produces a mechanical obstruction to the passage of the air from the mouth into the trachea; to extract foreign substances from the air passages; and to facilitate the performance of artificial respiration in cases of suspended animation.

The first class comprehends the various species of quinsey, inflammations of the throat caused by drinking hot water or corrosive acids, swelling of the tongue from the excessive action of mercury or from the sting or bite of venomous animals, foreign bodies of large size in the pharynx or upper part of the œsophagus, the development of polypi or other tumours in the larynx or between the œsophagus and larynx, and certain cases of wounds in the throat producing so much swelling as to threaten suffocation. The occurrence of any of these may render necessary the performance of bronchotomy, but some demand it more certainly than others; in some it must be performed in the first instance, in others it is

proper to give an efficient trial to other modes of relief before proceeding to this operation. In acute cynanche laryngea it will often be necessary to have recourse to bronchotomy; whilst in the chronic species, and in cynanche tonsillaris, there are so many powerful remedies which usually have the effect of controlling and curing these diseases, that it will seldom be required. In inflammations of the throat caused by drinking boiling water or corrosive acids, and in tumefaction of the tongue, we should in the first instance give a trial to the abstraction of blood, to calomel, and in the case of swelled tongue to deep and extensive scarifications. When suffocative paroxysms are induced by extraneous substances in the pharynx, we shall frequently be compelled to make an aperture in the trachea, in order to gain time either for the extraction or the forcing of them down. Tumours obstructing the air passages are generally of slow growth, and bronchotomy only is required when respiration can no longer be effected by the natural ways. And, lastly, wounds of the neck very seldom require the performance of the operation in question, but it has been considered necessary in some cases where œdema of the glottis has supervened, or where the tumefaction of the parts in the vicinity of the larynx has been so great as to threaten speedy suffocation.

With respect to the accidental falling of a foreign body into the larynx or trachea, I have already endeavoured to urge most forcibly the necessity of an immediate incision of the laryngeal cartilages, or of the trachea, according to the situation where the intruding substance is supposed to have located itself. The only cases in which there is the slightest reason for hesitating, are those where circumstances render it probable that the foreign body has become impacted in the bronchi.

The third and last class of cases, for the relief of which the operation of bronchotomy may sometimes be called into requisition, consists of those in which apparent death has resulted from submersion, or from the inhalation of noxious gases. In these instances an opening is made in the crico-thyroid space, or in the windpipe, for the purpose of introducing the pipe of a pair of bellows for the more convenient accomplishment of artificial respiration. The substitution of an elastic tube, passed through the nostril into the trachea, for the operation of bronchotomy—a substitution first proposed by Desault, and insisted upon by him with great pertinacity—is more likely to be attended with happy results in cases of this description than in any others. The idea of the aperture of the glottis being closed by the abasement of the epiglottis upon it has long been exploded, and it is now well known that a tube passed in the manner just indicated, will, if directed by a scientific hand, readily find its way into the trachea. In these cases there is no irritability, no convulsive spasm, caused by the contact of the tube with a highly sensitive glottis, and the insufflation of air can be managed as well through a pipe introduced in this manner as through one passed into an opening in front of the air passages.

From these considerations it is evident, that, in cases of submersion, we should always, when it is possible, introduce an elastic tube through the nostril; but how frequently does it happen that, called on an emergency to the assistance of persons in whom animation is suspended, such a tube is not within our reach! Under these circumstances we must have recourse to bronchotomy, if we deem it advisable to inflate the lungs; for, whether our efforts at resuscitation are successful or not, the wound caused by the operation is of no importance compared with the risk of losing a life by neglecting its performance.

Tracheotomy may also be required during the insensibility produced by taking large quantities of ardent spirits or the narcotic poisons, as opium and prussic acid. In such cases artificial respiration is sometimes rendered necessary by the prostration of the whole muscular energies, and consequently of those of the respiratory muscles;¹ and in the absence of a proper tube for introduction into the glottis by way of the nostril, an opening must be made into the larynx or trachea, to allow of the insertion of the pipe of the bellows.

I shall next endeavour to point out some of the reasons why bronchotomy so frequently fails to afford complete and lasting relief in cases where the propriety of its employment is unquestionable: and amongst these stands, first and foremost, *delay* in the time of its performance. I have already said so much upon the evil consequences that result from this delay, that I shall here simply recapitulate the morbid effects that ensue from the long continued existence of an impediment to the passage of the air to and from the lungs. The lungs themselves become loaded with blood in the first instance, which is but slowly transmitted through their vessels, on account of the increased pressure exerted upon the external surface of these organs by the labouring of the respiratory muscles to impel and expel the air, and still more because of the paralysed state of the left ventricle of the heart from the circulation, through the brain, of imperfectly arterialised blood. The impeded state of the pulmonary circulation soon gives rise to serous effusion in the parenchymatous structure of the lungs, in the same way, probably, that the obstruction of any of the large veins of the extremities produces serous infiltration in the cellular tissue of the affected limb. The struggle for breath still continuing, the air vesicles of the lungs become ruptured, and emphysema is the consequence. At first the air escapes only under the pleura and between some of the lobules; but ultimately it finds its way by the roots of the lungs into the posterior mediastinum, and thence to the lower part of the neck. The circulation of venous blood in the arteries of the brain soon induces its wonted effects upon this important organ: a state of stupor is one of the first consequences; languor steals over the senses, and the muscular energies are

¹ Medico-Chirurgical transactions, vol. xx. pp. 46 and 86.

annihilated; the heart's action is still more depressed; the vessels of the brain become congested; serum is poured into the ventricles; and convulsions and coma ultimately supervene.

To perform bronchotomy on a patient who has been long suffering from an impediment to respiration, and in whom there is reason to suspect a congested state of the brain, is but to afford him a slender chance of recovery; but relief from the extreme muscular labour of respiring under these circumstances is speedily obtained; and, if serous infiltration has not taken place either into the structure of the lungs or into the ventricles of the brain, we may sometimes succeed in giving permanent relief.

When bronchotomy is performed for the cure of inflammatory diseases of the upper parts of the air tube, *delay* may prevent its good effects by allowing the extension of the morbid action to the bronchial tubes and the air cells of the lungs. In these cases immediate relief may follow the opening of the trachea by permitting the escape of accumulated mucous secretions, and the unrestricted ingress and egress of the air in respiration; but fresh quantities of mucus are poured out by the bronchial membrane, the difficulty of expelling it is increased by the operation which has been performed, and the patient dies in a short time with symptoms of overloaded cerebral circulation. This is the general progress and termination of croup, after bronchotomy has been done for its relief.

The assertion, that the expulsion of mucus from the bronchial tubes is effected with greater difficulty after the performance of the operation than before, appears improbable; but numerous facts witness to its truth, and the circumstance may be accounted for in this manner:—On ordinary occasions, when secretions of any kind accumulate in the bronchi, a fit of coughing ensues, and the offending matter is gradually or suddenly expelled by repeated strong contractions of the chest; but a cough is not simply a quick contraction of the chest by means of the expiratory muscles; it is always accompanied, or rather preceded, by a closure of the glottis, during which the air within the chest is condensed by the action of the expulsive muscles, and, on the sudden relaxation of the rima, the air and mucus within the bronchial tubes are driven out with great force and with an audible noise. When an artificial aperture has been made in the larynx or trachea, coughing cannot take place, because there are no muscles that can temporarily close the new opening; and therefore the benefit of the strong expulsive action of coughing is quite lost. In cases where the bronchi are much obstructed with mucus after the trachea has been incised, it might be advantageous to endeavour to imitate the natural method of relief, by closing the artificial opening after a deep inspiration by means of the finger, and then directing the patient to expel the air from the chest with all the force he can master, suddenly to withdraw the finger.¹

¹ This subject has been amply treated on and illustrated by Dr. Cullen, in the 29th vol. of the Edinburgh Medical and Surgical Journal, p. 75.

Other causes of the ultimate failure of bronchotomy, are the artificial opening in the trachea or larynx not being sufficiently large in the first instance, its not accurately corresponding with the incision of the integuments, and a want of attention in keeping both incisions open and in cleansing them from the secretions ejected from the air tubes. To provide a sufficient opening for comfortable breathing, when no canula is introduced, the aperture made by the operation should be larger than the rima glottidis, and should be formed, according to the opinions of the best surgeons, by the removal of a portion of the tube. The natural disposition of the parts to close again is so strong, that, unless means be adopted to prevent it, the operation will soon, by this occurrence, be rendered vain and useless. The introduction of a canula is one of the most effectual measures for keeping the wound open; and if tracheotomy has been performed, this instrument can be borne for a very considerable length of time without exciting unpleasant effects. But the use of a canula, the adoption of a particular position of the head, or a recourse to any instrumental contrivance for keeping open the wound, will avail nothing, without constant attention on the part of the surgeon or the attendants of the patient to keep the newly-made aperture free from pus or mucus, which is continually collecting about the edges of the wound. The canula, when such an instrument is made use of, must be frequently removed and cleansed; and if the artificial opening is left without any contrivance for preventing its closing, the most unceasing efforts of the medical attendant must be directed to the removal of every obstructing matter the moment that it presents itself. This collection of mucus around the edges of the aperture is one of the most annoying occurrences to the patient; he has not strength enough to project it far, and, consequently, at every inspiration it is sucked again into the trachea, producing in time all the symptoms of impeded respiration, and causing the patient to sink into an alarming state of debility. Mr. Porter,¹ in two instances, when the patients were almost suffocated with the mucus, struggling for breath, and so debilitated as to be unable to assist themselves, has seen an assistant put his lips to the wound and empty the trachea by suction: but this is so disgusting an operation, that few would have zeal enough to undertake it; and happily the same results may be produced most commonly by the application of a syringe to the opening in the trachea, and the removal of the mucus by its means.

The artificial cough, effected in the manner described in the last page, appears, from the statements of Dr. Cullen and Mr. Craigie,² to assist most powerfully in expelling the mucus from the bronchi, and in facilitating respiration. In a patient of Dr. Cullen's, the larynx had been opened for a suicidal purpose, and inflammation of the bronchial membrane had taken place afterwards; the accumu-

¹ Pathology of the Larynx, p. 265.

² Edinburgh Medical Journal, vol. xxxix.

lation of mucus in the air tubes was exceedingly great, and could not be expelled; "the extremities became cold, the lips livid, and the pulse hardly perceptible; the respiration rare, difficult, and accompanied with a frightful rattle in the bronchi." The patient was desired to cough, but could not till Dr. Cullen placed his finger on the artificial opening in the larynx; she then coughed readily enough, and brought up some very tenacious mucus, by the excretion of which the respiration was greatly improved, and the lips and expression of the countenance became natural. Ultimately she died of suffocation from the accumulation of the mucus. In Mr. Craigie's case the trachea was opened, to prevent suffocation from the effects of cynanche tonsillaris; relief followed the operation, but in an hour after, mucus accumulated to such an extent as nearly to choke the patient, and it could only be expelled from the trachea by diminishing for a time the size of the opening in this tube by laying a finger across the upper part of the wound and then directing the patient to cough; by this exertion he was enabled to throw out the mucus, and completely to re-establish a comfortable state of respiration. I have myself successfully adopted this expedient after the operation of tracheotomy. Directly that the trachea was opened, the blood flowed so fast into this tube that the patient's life was in imminent peril. By holding open the artificial aperture till a deep inspiration had been taken, and then closing it again, the patient was enabled to cough up the blood; this was repeated many times, and always with relief.

Respecting the dressing of the wound inflicted in bronchotomy little need be said; the mode of dressing it must depend upon the nature of the disease for the relief of which it has been made. If it is requisite to keep the wound open, nothing more can be done than just to smear the incised parts with oil, in order to prevent their desiccation by the constant passage of the air over them, or their irritation from the contact of the mucus from the air tubes. If, on the contrary, it is desirable to close the wound immediately, its edges must be approximated by strips of adhesive plaster, and supported by a bandage continued round the neck. If the wounds in the integuments and in the trachea are longitudinal, very little attention to posture will be needed, though motion of the head from side to side should be avoided as much as possible. If the incision in the larynx or trachea has been made in a transverse direction, the head must be approximated to the breast by an appropriate bandage, and maintained in that position for several days. The wound made in bronchotomy generally heals in from two to three weeks, but often much sooner.

The relative advantages of laryngotomy and tracheotomy deserve some consideration; the former claims our preference on account of the greater facility with which it can be accomplished, and the smaller risk to life that exists during its performance. The latter

has to offer in its favour the greater certainty of relief, the distance of the wound made in the operation from the part morbidly affected, and the larger space that is afforded for the incision in cases where an extensive aperture is required. Where a foreign body of any size has fallen into the trachea, the division of this tube is absolutely required for its extraction; when, on the other hand, a foreign body has become fixed in the rima glottidis, or in the ventricles of the larynx, laryngotomy is equally necessary for its removal.

Laryngotomy is much more easy of execution than the rival operation; the cryco-thyroid membrane is covered only by integument, and the situation at which the incision should be made is well-marked and prominent, and much less likely to be affected with emphysema, though equally exposed to serous or purulent infiltration with the tegumentary covering of the trachea. The opening made by the operation can be readily kept open without the use of a canula, on account of the slight depth of the wound. Where the morbid action is transitory or confined to the more external parts of the larynx, as in spasm of the glottis and the tea-kettle cases, or where the opening is only wanted for the performance of artificial respiration, laryngotomy should be preferred. In acute and chronic laryngitis, in croup, in disease of the laryngeal cartilages, in ulceration of the larynx, and in the case of the development of a tumour between the trachea and œsophagus, we must have recourse to the division of the trachea. The advantages of laryngotomy over tracheotomy have been strongly insisted on by Vic-d'Azyr, Sabatier, and Desault; and in every case where equal benefit may be expected to accrue to the patient, we cannot hesitate in giving a preference to the former, on account of its comparative freedom from danger. The age of the patient should have some weight with us, for in young persons the crico-thyroid space is very much smaller than in adults, and would scarcely afford sufficient room for easy respiration. The distance between the lower border of the cricoid cartilage and the sternum, is nearly the same in adult males and in children, because in the former the larynx becomes so much larger at the age of puberty, that the portion of the trachea above the sternum diminishes considerably in length about this time. On these grounds it would appear that laryngotomy is but little adapted for children, and should not be had recourse to under ordinary circumstances.

It only remains to examine whether the introduction into the trachea of an elastic tube by the mouth, or by the nostrils, is capable, in any description of cases, of supplying the place of bronchotomy, and under what circumstances it may be equally serviceable.

The practice of introducing a tube into the air passages in those cases of quinsey where suffocation appears to be rapidly approaching, was first recommended by Hippocrates, and probably remained in use till Asclepiades, by proposing bronchotomy in the same cases,

caused its discontinuance. After the time of the latter author, the introduction of elastic tubes to prevent suffocation, fell into complete desuetude, till the practice was again revived and strenuously advocated by Desault.¹ Desault, in consequence of two or three unfortunate cases in which the attempt to perform tracheotomy was productive of a fatal result, seems to have held this operation in great horror, and is perhaps considerably influenced by his feelings in recommending the introduction into the trachea of an elastic tube by way of the nostrils, as a remedy for suffocation arising from any cause except acute inflammations of the larynx and trachea, or the lapse of foreign bodies into these passages. In favour of the adoption of this plan, he urges, 1st, the perfect facility with which it can be carried into execution; 2d, the safety and efficiency of the practice; 3d, the avoiding the danger of the performance of bronchotomy; and 4th, that no wound remains to be healed, no aerian fistula to be dreaded.

All authors are not perfectly in accord with regard to the facility with which the elastic tube can be introduced into the larynx. Unless in cases where animation is suspended, and where, consequently, the irritability of the glottis has ceased, there is reason to believe that a convulsive cough and inconceivable distress are produced by the attempt to introduce a tube into the larynx, and that these are renewed every time that the instrument comes in contact with the glottis. These occurrences must be very perplexing to an inexperienced practitioner, and, if the operation be attempted during the existence of chronic inflammation or ulceration of the larynx, seriously hurtful to the patient. The difficulty of directing the tube is considerable: it may pass either into the larynx or the pharynx. In the latter case it must again be withdrawn, and a curved stilet passed down it with the concavity forwards. The determined shape and the solidity which this addition gives to the tube, will greatly increase the facility of its introduction.

The safety of the practice is undeniable; but its efficiency is certainly open to controversy. If the tube be of large size, the difficulty of passing it through the rima glottidis will be very great; and if it be small, it will soon be clogged with the mucous secretions of the air passages, when, of course, it must be removed to be again replaced. The very presence of the tube will create an increased secretion, and if any inflammatory disposition be present in the air passages, it will be fostered by the irritation of an extraneous body.

An avoidance of the dangers of bronchotomy, and of the trouble of the wound which this operation leaves behind it, is unquestionably an advantage, if reliance can be placed upon the means offered as a substitute. Most of the modern improvements in surgery have for their object the simplifying or the abolition of the necessity for operations; but it would be the height of weakness and of negli-

¹ Œuvres Chirurgicales, par Bichat, tome ii.

gence to be deterred from the execution of a tolerably certain mode of relief by the unfortunate result of two or three cases, and to place our trust, when life is at stake, upon means of doubtful character, and that offer very equivocal prospects of success. The fear of an aerial fistula appears to be almost groundless. Mr. Porter met with one case of this kind,¹ which was the result of a shot-wound in the neck, that had comprised the whole length of the thyroid cartilage, the cricoid, and two or three rings of the trachea. The wound had all healed by an irregular cicatrix, except one spot corresponding to the space between the thyroid and the cricoid cartilages, where there was a fistulous opening large enough to admit a goose-quill, through which the patient breathed and occasionally expelled mucus by coughing. This was fifteen months after the infliction of the wound. From the silence of writers generally on the subject of aerial fistulæ, and especially of those writers who wish to depreciate bronchotomy, we may conclude that they are of exceedingly rare occurrence; in fact, after the operation of bronchotomy, the chief difficulty always is to prevent the wound healing too rapidly.

We are justified, I think, in concluding, from the foregoing considerations, that the only cases in which the introduction of an elastic tube is worthy of a trial are those where the object is to inflate the lungs during the state of suspended animation, or where there is danger of suffocation from any evanescent cause external to the cavity of the larynx, as enlargement of the tonsils or tongue; but that in inflammatory affection of the larynx or trachea, in the case of foreign bodies in these organs or in the pharynx, the introduction of an elastic tube would be either hurtful or completely useless.

¹ Op. cit. p. 256.

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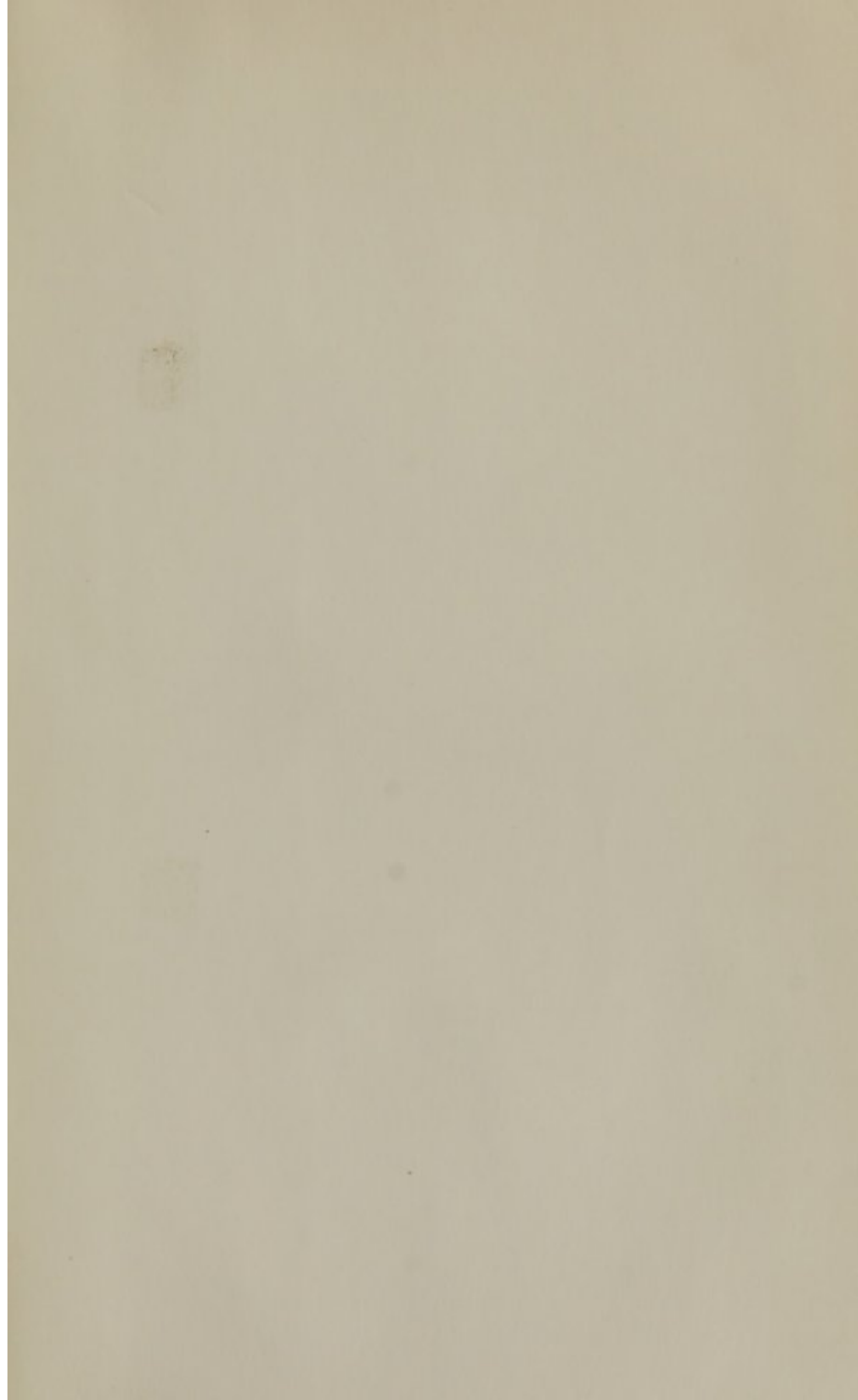
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